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Title : Maritime navigation and radiocommunication equipment and systems - Automatic Identification Systems - Part 1: AIS Base Stations - Minimum operational and performance requirements - methods of test and required test results

Introductory note

IEC 62320-1 is the first part of an intended series of standards for fixed equipment for the Automatic Identification System. Mobile shipborne equipment has been specified in standards such as 61993-1 (Class A for SOLAS application) and 62287-1 (Class B for non-SOLAS application). This standard specifies equipment for Base Stations. Subsequent parts will specify equipment for Aids to Navigation.

ATTENTION
VOTE PARALLÈLE
CEI – CENELEC

L'attention des Comités nationaux de la CEI, membres du CENELEC, est attirée sur le fait que ce projet de comité pour vote (CDV) de Norme internationale est soumis au vote parallèle.
Un bulletin de vote séparé pour le vote CENELEC leur sera envoyé par le Secrétariat Central du CENELEC.

ATTENTION
IEC – CENELEC
PARALLEL VOTING

The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) for an International Standard is submitted for parallel voting.
A separate form for CENELEC voting will be sent to them by the CENELEC Central Secretariat.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS- AUTOMATIC IDENTIFICATION SYSTEM -

Part 1: AIS Base Stations - Minimum operational and performance requirements - methods of test and required test results

FOREWORD

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International Standard IEC 62320-1 has been prepared by IEC Technical Committee 80:

The text of this standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IEC 62320 consists of the following parts, under the general title: *Maritime navigation and radiocommunication equipment and systems – Automatic Identification System*

Part 1: AIS Base Stations

Part 2: AIS fitted to Aids to Navigation

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date[1)] indicated on the IEC web site under

1) The National Committees are requested to note that for this publication the maintenance result date is 2008-01

"http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

Chapter V of the 1974 SOLAS Convention requires mandatory carriage of Automatic Identification System (AIS) equipment on all vessels constructed on or after 01 July 2002. Implementation for other types and sizes of SOLAS Convention vessels was required to be completed not later than 31 December 2004.

SOLAS Chapter V, Regulation 19, section 2.4.5 states that AIS shall:

1. provide automatically to appropriate equipped shore stations, other ships and aircraft information, including ship's identity, type, position, course, speed, navigational status and other safety-related information;
2. receive automatically such information from similarly fitted ships;
3. monitor and track ships; and
4. exchange data with shore-based facilities."

In addition, the IMO Performance Standards for AIS states that:

- The AIS should improve the safety of navigation by assisting in the efficient navigation of ships, protection of the environment, and operation of Vessel Traffic Services (VTS), by satisfying the following functional requirements:
    1. in a ship-to-ship mode for collision avoidance;
    2. as a means for littoral States to obtain information about a ship and its cargo; and
    3. as a VTS tool, i. e. ship-to-shore (traffic management).
- The AIS should be capable of providing to ships and to competent authorities, information from the ship, automatically and with the required accuracy and frequency, to facilitate accurate tracking. Transmission of the data should be with the minimum involvement of ship's personnel and with a high level of availability.

The provision of Shore Based AIS will be necessary to attain the full benefit of the SOLAS Convention requirements.

This standard provides the minimum operational and performance requirements, methods of test and the required test results for AIS Base Stations. The testing is divided into three sections, the transceiver tests, the logical tests and the Presentation Interface tests. These are captured in sections 8, 9 and 10 respectively. The method used for testing is that the EUT should meet all the tests requirements of section 8 before proceeding to section 9. Likewise the unit shall meet all of the test requirements before proceeding to section 10. Section 10 has also been prioritised such that the tests are progressive

Sections 5 to 7 provide functional requirement information and section 8 provides the general test environment for the EUT.

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS - AUTOMATIC IDENTIFICATION SYSTEM -

Part 1: AIS Base Stations - Minimum operational and performance requirements - methods of test and required test results

1 Scope

This part of 62320 specifies the minimum operational and performance requirements, methods of testing and required test results for AIS Base Stations, compatible with the performance standards adopted by IMO Res. MSC.74 (69), annex 3, Universal AIS. It incorporates the technical characteristics of non-shipborne, fixed station AIS equipment, included in recommendation ITU-R M.1371-1 and IALA Recommendation A-124. Where applicable, it also takes into account the ITU Radio Regulations. This Standard takes into account other associated IEC International Standards and existing national standards, as applicable.

This standard is applicable for AIS Base Stations. It does not include specifications for the display of AIS data on shore.

NOTE Text of this standard, that conforms to that in IMO resolution MSC.74(69), Annex 3 or to that in ITU-R Recommendation M.1371-1 is referenced (abbreviated to – A3) or the recommendation (abbreviated to – ITU-R M.1371-1) and paragraph numbers are indicated in parentheses i.e. (A3/3.3) or (ITU-R M.1371-1/3.3) respectively.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61162-1, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners*

IEC 61162-2, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 2: Single talker and multiple listeners, high-speed transmission*

IMO 1974, *International Convention for the Safety of Life at Sea (SOLAS) as amended*

IMO Resolution MSC.74(69), Annex 3, *Recommendation on performance standards for AIS*

IMO MSC 140(76) *Recommendation for the protection of the AIS VHF data link*

ITU-R Recommendation M.1084-4, *Interim solutions for improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service.*

ITU-R Recommendation ITU-R M.1371-1 *Technical Characteristics for a Universal Shipborne Automatic Identification System Using Time Division Multiple Access in the VHF Maritime Mobile Band.*

ITU-T Recommendation O.153, *Basic parameters for the measurement of error performance at bit rates below the primary rate.*

IALA Recommendation A-124 *on Automatic Identification System (AIS) Shore Station and networking aspects Relating to the AIS Service, December 2002.*

IALA Technical Clarifications *on ITU Recommendation ITU-R M.1371-1, Edition 1.4, December 2003.*

RTCM SC104 - *RTCM Recommended Standards for Differential GNSS (Global Navigation Satellite Systems) Service, Version 3.0.*

3 Symbols and abbreviations

AIS	Automatic Identification System
BER	Bit Error Rate
BIIT	Built-In Integrity Tests
BT	Bandwidth Time product
CPU	Central Processing Unit
DGNSS	Diferential Global Navigation Satellite System
EPFD	Electronic position fixing device
EUT	Equipment under test
FATDMA	Fixed Access Time Division Multiple Access
GNSS	Global Navigation Satellite System
IALA	International Associaiton of Marine Aids to Navigation and Lighthouse Authorities
IHO	International Hydrographic Office
IMO	International Maritime Organization
ITU	International Telecommunications Union
kn	Knots
MAC	Medium Access Control
MKD	Minimum Keyboard and Display
MMSI	Maritime Mobile Service Identity
NM	Nautical Mile
NRZI	Non-Return to Zero Inverted
PER	Packet Error Rate
P_c	Carrier Power
PI	Presentation Interface
PPS	pulse per second
PSS	Physical Shore Station
RAIM	Receiver Autonomous Integrity Monitoring
RATDMA	Random Access Time Division Multiple Access
Rx	Receive
TDMA	Time Division Multiple Access
Tx	Transmit
UTC	Universal Time Co-ordinated
VDL	VHF Data Link
VSWR	Voltage Standing Wave Ratio
VTS	Vessel Traffic Services

NOTE Abbreviations related to IEC 61162 series are not included in the above list. For their meaning refer to that Standard and Annex A.

4 Functional layout of an AIS Base Station

4.1 General

The Base Station may be designed for dependent only operation or independent operation. Both are under some control of the Physical Shore Station (PSS) as defined in the IALA Recommendation A-124.

- A dependent Base Station accesses the VHF data link (VDL) using TSA+VDM sentence pair only (see Table 1), as provided by the PSS.

- An independent Base Station accesses the VDL using the TSA+VDM pairs as provided by the PSS or by using its own slot table and internal control. When operated as an independent Base Station the unit may be delegated certain autonomous functionality under the supervisory control of the PSS.

The PSS is a controlling entity responsible for configuration of Base Stations, scheduling of transmission and processing of received information. The PSS is also responsible for ensuring the integrity of the VDL.

The tests in this standard are for all Base Stations. Additional tests for independent Base Stations are indicated at the start of the tests by a note.

4.2 Functional block diagram of an AIS Base Station

Figure 1 shows the principal components of the AIS Base Station.

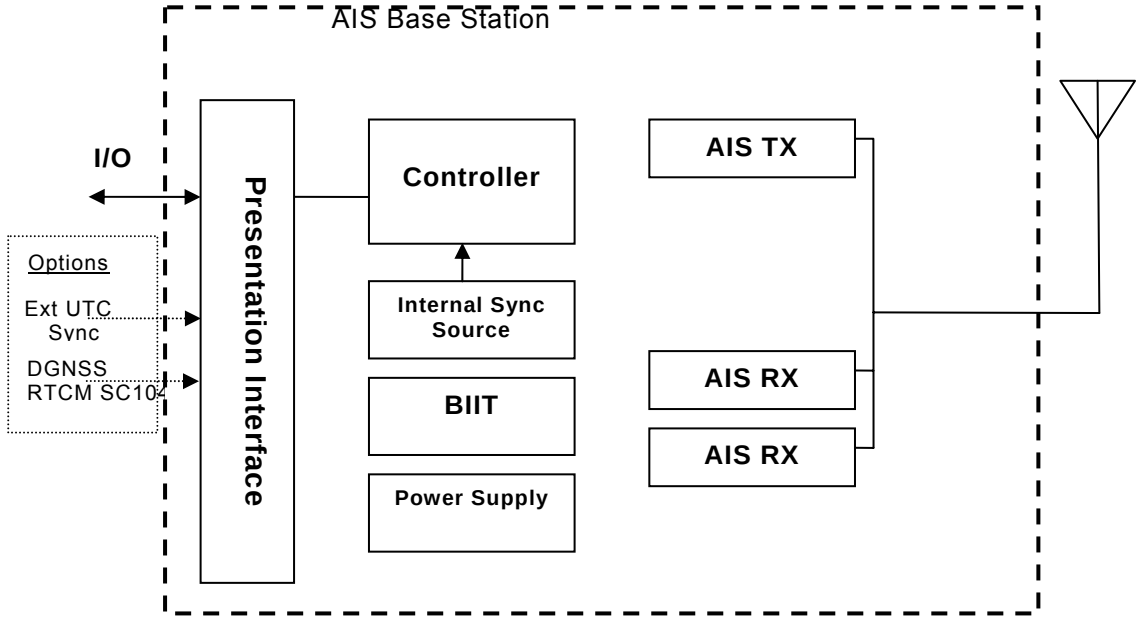

Figure 1 - Functional block diagram of an AIS Base Station

As a minimum, the following functional elements are required for the AIS Base Station.

- Two multi-channel receivers
- One multi-channel TDMA transmitter

NOTE Since the minimum configuration of the AIS Base Station has only one transmitter, the AIS Base Station cannot transmit on both AIS Channels (AIS A and AIS B) simultaneously.

- A controlling unit, which Includes a serial number assigned by the manufacturer, unique to each Base Station, providing a secure method to access the Base Station and which will allow for change of MMSI when required.
- An internal synchronisation source, which may also be used as a position sensor for independent Base Stations.
- A Built-In-Integrity-Test unit (BIIT), which shall provide alarms
- A power supply
- A Presentation Interface (PI), which allows the AIS Base Station to output and receive data from PSS.
- Optional Features, for example: DGNSS (RTCM SC104); External Synchronization.

4.3 General VDL Requirements

The AIS Base Station interacts with the VDL by receiving and transmitting VDL messages.

4.3.1 Sources of VDL Messages for Transmission

In order to transmit VDL messages the Base Station may derive the messages to be transmitted from three sources:

1) Generate and transmit VDL messages autonomously as per the configuration received via sentences.
2) Generate and transmit VDL messages automatically based on data input received via the PI, using different sentences than the VDM.
3) Transmit predefined VDL messages input via the PI. The VDM sentence shall be used to input the content of the VDL messages via the PI to the AIS Base Station. The VDL message shall then be transmitted by the Base Station on the VDL.

When operating the Base Station independently, these three VDL message sources shall be supported in parallel.

When operating the Base Station dependently, only VDM messages received via the PI shall be transmitted as noted in 3) above.

4.3.2 Use of Access Schemes

4.3.2.1 Dependent Operation:

When operating as a dependent Base Station the FATDMA access scheme shall be used. The Base station shall use the slot provided by a TSA+VDM sentence pair.

Dependent Operation shall not use the RATDMA access scheme

4.3.2.2 Independent Operation:

The default access scheme for a Base Station shall be FATDMA.

The AIS Base Station may use the FATDMA and RATDMA access schemes concurrently.

The use of pre-reserved FATDMA slots shall take priority over RATDMA access.

When using the FATDMA access scheme, the absolute slot numbers for transmission shall be determined by one of the following methods:

- The PI sentence pair TSA+VDM shall provide the absolute slot number in which the AIS Base Station transmits;
- The AIS Base Station shall autonomously select an appropriate pre-reserved FATDMA slot determined by the configuration as previously provided via the PI;
- The Base Station shall be capable of using the two methods concurrently.

4.4 Functional Diagram for Operation of a Base Station

Figure 2 shows the principal components of an AIS Base Station. The diagram identifies the elements of the AIS Base Station and the interface with the PSS.

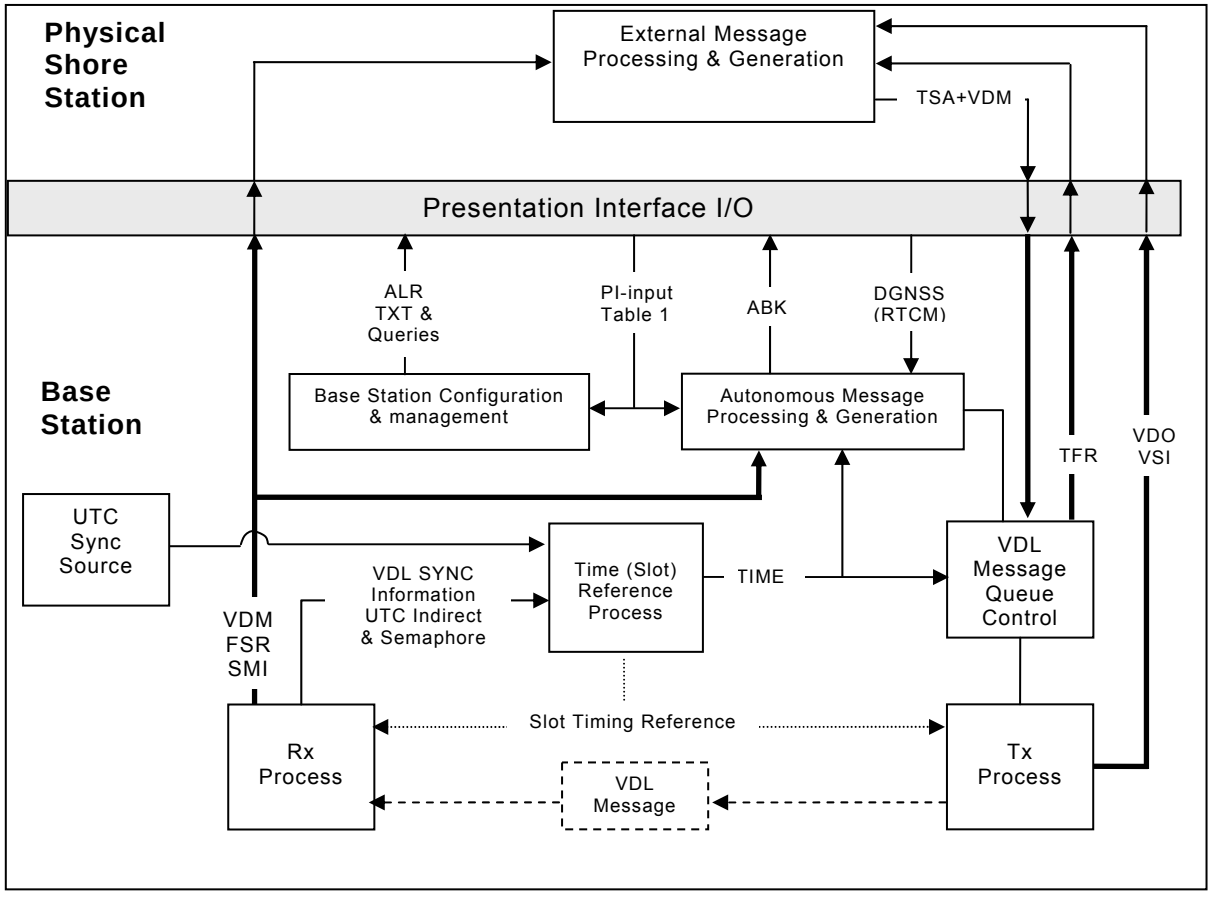

Figure 2 - Functional block diagram Dependent and Independent Operation

The PI of an AIS Base Station consists of at least one input/output port. A specific choice for the physical input/output port is not specified. The purpose of the PI is to:

- Exchange VDL messages with the PSS
- Configure the Base Station
- Enable real time control of the Base Station
- Provide an output for BIIT alarms and status

The information exchange of the PI is supported by a combination of IEC 61162-1 sentences and Base Station sentences (sse Annex A).

4.5 Base Station Input / Output Sentence Formatters

The following table lists sentence formatters used with a Base Station. It includes existing sentence formatters (grey rows) and sentence formatters developed for use with

Base Stations (white rows). Annex A.1 contains the details for each of the sentence formats developed for AIS Base Stations.

A sentence linking method is described in Annex A.2. Use of this method improves the integrity of data relationships between sentences, and improves the reliability and clarity of communications with the Base Station.

Table 1 presents both input and output sentence formatters for dependent and independent operation. For Base Stations that support both independent and dependent operation, both sets of sentences are applicable. For Base Stations that only support depenent operation, the sentences for dependent operation are applicable and all other sentences are ignored.

Table 1 - Base Station Input / Output Sentence Formatters

Sentence Formatter	Input Independent	Input Dependent	Output Independent	Output Dependent	Description
ABK			**X**		Addressed and binary broadcast acknowledgement
ABM	**X**				Addressed binary and safety related message
ACA	**X**		**Q**		AIS Regional Channel Assignment Message
ACM	**X**				Preparation and initiation of an AIS Base Station broadcast of an Addressed Channel Message (VDL Message 22)
ACK	**X**	**X**			Acknowledge Alarm
ADS			**X**	**X**	AIS Device Status (output once per minute and upon status change)
AGA	**X**				Preparation and Initiation of an AIS Base Station broadcast of a Group Assignment Message (Message 23).
ALR			**X**	**X**	Set Alarm State
AIR	**X**				AIS Interrogation Request (VDL Message 15)
ASN	**X**				Preparation and initiation of an AIS Base Station broadcast of Assignment VDL Message 16
BBM	**X**				Broadcast Binary Message
BCE	**X**	**X**	**Q**	**Q**	General Base Station Configuration Extended
BCF	**X**	**X**	**Q**	**Q**	General Base Station Configuration
CAB	**X**	**X**	**Q**	**Q**	Control AIS Base Station
CBM	**X**		**Q**		Configure Base Station message broadcast rates
DLM	**X**		**Q**		Data Link Management slot allocations for Base Station (VDL Message 20 – FATDMA reservations)
ECB	**X**		**Q**		Configure Broadcast Rates for

Sentence Formatter	Input Independent	Input Dependent	Output Independent	Output Dependent	Description
					Base Station messages with epoch planning support
FSR			**X**	**X**	Frame Summary of AIS Reception
SID	**X**	**X**			Installation of a Stations Identification
SPO	**X**	**X**	**Q**	**Q**	Select AIS Device's Reception Processing and Output
TFR			**X**	**X**	Transmit feed-back report – Base Station report on status of requested transmission
TSA	**X**	**X**			Transmit Slot Assignment – used to identify AIS time slot used to transmit the content of a VDM sentence
TSP	**X**	**X**			Transmit Slot Prohibit
TSR			**X**	**X**	Transmit Slot Prohibit status Report
TXT			**X**	**X**	General purpose text transmission
VDM	**X**	**X**	**X**	**X**	VHF Data-link message
VDO			**X**	**X**	VHF Data-link Own-vessel message
VER			**Q**	**Q**	Version information about equipment
VSI			**X**	**X**	VDL Signal Information

Note 1: "X" indicates input to, or output from, the AIS Base Station. "Q" indicates that the sentence may be externally requested using the IEC 61162-1 "$AIAIQ,xxx" query sentence (See Annex A) method(s) in order for the identified sentence to be output.

Note 2: Sentence formatters shown in shaded rows are described in IEC 61162-1.

The AIS Base Station shall output, autonomously and periodically, the ADS sentence on the PI indicating the Base Station status. This shall be output once per minute or when there is a change in the status.

5 Functional Definition of the Radio Interface of the AIS Base Station

The physical layer of the AIS Base Station shall be designed in accordance with the following minimum requirements.

5.1 General Requirements of the Physical Layer

The following general requirements apply to all receivers and transmitter:

- A Base Station shall use simplex channels or duplex channels in either full-duplex or half-duplex mode (ITU-R M.1371-1, Annex 2).
- A Base Station shall be capable of 25 kHz and, optionally, 12,5 kHz emission / reception in accordance with ITU-R M.1084-4, Annex 3 (as referenced by Recommendation ITU-R M.1371-1, Annex 1).
- A Base Station shall be capable of transmitting using at least two different power settings, as provided for by ITU-R M.1371-1and IALA Technical Clarifications for ITU-

R M.1371-1. The Base Station shall have the capability to set its power level as stipulated by an input command.

5.2 Required Parameter Settings for the Physical Layer of the AIS Base Station

Table 2, Table 3 and Table 4 are derived from Recommendation ITU-R M.1371-1, Annex 2 and give the parameters required for an AIS Base Station.

NOTE For the meaning of the symbols and additional information refer to the appropriate section of Recommendation ITU-R M.1371-1, Annex 2.

The constants of the physical layer of the AIS Base Station shall comply with the values given in Table 3 and Table 4.

Table 2 - Required parameter settings for an AIS Base Station

Symbol	Parameter Name	Low setting	High setting
PH.RFR	Regional frequencies	156,025 MHz	162,025 MHz
PH.CHS	Channel spacing	12,5 kHz Optional	25 kHz
PH.AIS1	AIS 1 (default channel 1)	161,975 MHz	161,975 MHz
PH.AIS2	AIS 2 (default channel 2)	162,025 MHz	162,025 MHz
PH.CHB	Channel bandwidth	12,5 kHz Narrow Optional	25 kHz Wide
PH.BR	Bit rate	9 600 bps	9 600 bps
PH.TS	Training sequence	24 bits	24 bits
PH.TST	Transmitter settling time (Transmit power within 20% of final value, Frequency stable to within ± 1.0 kHz of final value)	≤ 1,0 ms	≤ 1,0 ms

Table 3 - Required Settings of Physical Layer Constants

Symbol	Parameter name	Value
PH.DE	Data encoding	NRZI
PH.FEC	Forward error correction	Not used
PH.IL	Interleaving	Not used
PH.BS	Bit scrambling	Not used
PH.MOD	Modulation	Bandwidth adapted; GMSK/FM (seeTable 3)

Table 4 - Bandwidth dependent parameters of the Physical Layer of the AIS Base Station

Symbol	Parameter name	PH.CHB / Narrow	PH.CHB / Wide
PH.TXBT	Transmit BT-product	0.3	0.4
PH.RXBT	Receive BT-product	0.3	0.5
PH.MI	Modulation Index	0.25	0.50

5.3 Minimum Requirements for the TDMA Receivers of the AIS Base Station

The technical characteristics as specified in Table 5 shall apply to the TDMA receivers.

Table 5 - Minimum Required Receiver Characteristics

Receiver Parameters	25kHz channels	12,5kHz channels
Sensitivity	20% PER for –107 dBm	20% PER for –98 dBm
Co-channel rejection	-10 dB – 0 dB	-18 dB – 0 dB
Adjacent channel selectivity	70 dB	50 dB
Spurious response rejection	70 dB	70dB
Intermodulation response rejection and Blocking	20 % PER	20 % PER

5.4 Shutdown Procedure for an AIS Base Station

An automatic transmitter hardware shutdown procedure and indication shall be provided in case a transmitter continues its transmission at the end of its transmission period. This feature shall be independent of the Base Station software control. The AIS Base Station shall shut down the TDMA transmitter in less than 2 s.

6 Requirements for AIS Base Station

6.1 Introduction

This section describes the requirements for a Base Station operating as a dependent or independent station.

The Base Station may be operated as an Independent station that contains all of the functionality or as a dependent station that relies on external functionally. Both are the responsibility of the Competent Authority operating the station.

When operated as a dependent Base Station the unit operates under full control of the PSS.

When operated as an independent Base Station the unit may be delegated certain autonomous functionality under the supervisory control of the PSS.

6.2 Requirements a Base Station Operated as a Dependent Unit

This section describes the functional requirements of an AIS Base Station operating as a dependent unit with regard to internal processing of AIS VDL messages and sentences.

6.2.1 General Rules

When operating as a dependent Base Station, the unit shall comply with the following general rules:

- Each AIS Base Station shall, as a default, be identified by its own individual MMSI. The AIS Base Station MMSI shall be configurable by means of a SID sentence via the PI.
- The AIS Base Station shall be capable of transmiting messages with a different MMSI provided by the PSS by means of a standard VDM input sentence.
- The AIS Base Station shall be able to receive all VDL messages;

- Every received VDL message shall be passed to the PI as a VDM sentence without further data content processing;
- Every received PI VDM sentence shall be broadcast on the VDL beginning in the slot indicated by the TSA sentence without further data content processing;
- Every message transmitted on the VDL shall be passed to the PI as a VDO sentence;
- Messages to be broadcast on the VDL are passed using the sentence linking method (see Annex A)
- A dependent Base Station does not transmit Message 4 without PSS control. All transmissions are done via TSA+VDM PI input sentences.
- A dependent Base Station shall not be semaphore qualified and shall not operate autonomously.
- When the UTC sync source is unavailable, the AIS Base Station shall use UTC indirect (ITU-R M.1371-1 A2, 3.1.1.2), Synchronised to Base Station (ITU-R M.1371-1 A2, 3.1.1.3) or the semaphore rules (ITU-R M.1371-1 A2, 3.1.1.4)
- Upon request via the sentence VER, the AIS Base Station shall provide its hardware and software version information.
- Base Station shall use the FATDMA access scheme only.

6.2.2 General Processing Diagram

The AIS Base Station shall internally process data in accordance with Figure 3.

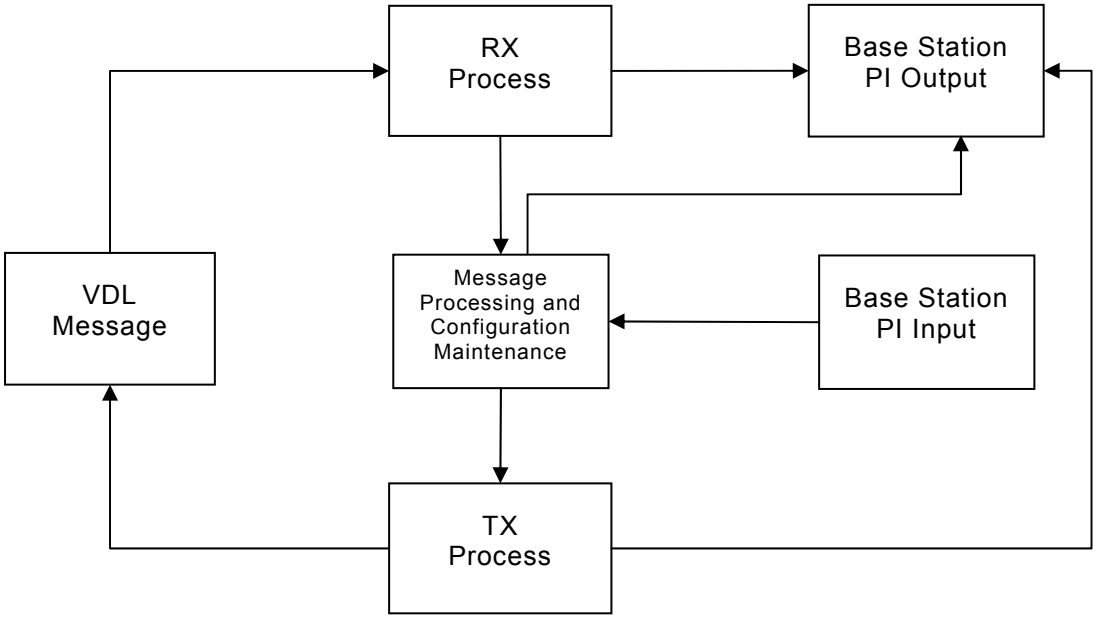

Figure 3 - General processing diagram

6.2.3 AIS Base Station Response to PI Input

The AIS Base Station shall respond to input sentences from the PI in accordance with Table 1, “Output Dependent” when operating as a dependent Base Station.

6.2.4 AIS Base Station Response to VDL Input

The AIS Base Station shall respond to input messages from the VDL in accordance with Table 6.

Table 6 - Base Station response to input messages from the VDL

VDL Input	Resulting PI Output	Resulting VDL Output	Resulting VDL reporting rate
Any message (regardless of MMSI)	VDM, VSI	Nil	Nil
All messages in a frame (regardless of MMSI)	FSR	Nil	Nil

6.3 Requirements for a Base Station For Independent operation

This section describes the functional requirements of an AIS Base Station operating as an independent unit with regard to internal processing of AIS VDL messages and sentences.

NOTE Requirements for Base Stations operating as an independent unit are in addition to the requirements for Base Stations operating as a dependent unit.

6.3.1 General Rules

When operating as an independent Base Station, the unit shall comply with the following general rules:

- With regard to the access schemes to the VDL, refer to section 6.3.4 AIS Base Station Interaction on the VDL.
- The AIS Base Station shall, as a default, use a surveyed position. When using a surveyed position, the “Position accuracy” flag in VDL Message 4 shall be set upon configuration, and the “RAIM” flag shall be set to 0.
- When the UTC sync source is unavailable, the AIS Base Station shall use UTC indirect (ITU-R M.1371-1 A2, 3.1.2) or the semaphore rules (ITU-R M.1371-1 A2, 3.1.1.4).
- If configured to be semaphore, the AIS Base Station shall revert to semaphore behaviour upon detection of semaphore condition on the VDL.

6.3.2 General Processing Diagram

The AIS Base Station shall internally process data in accordance with Figure 4

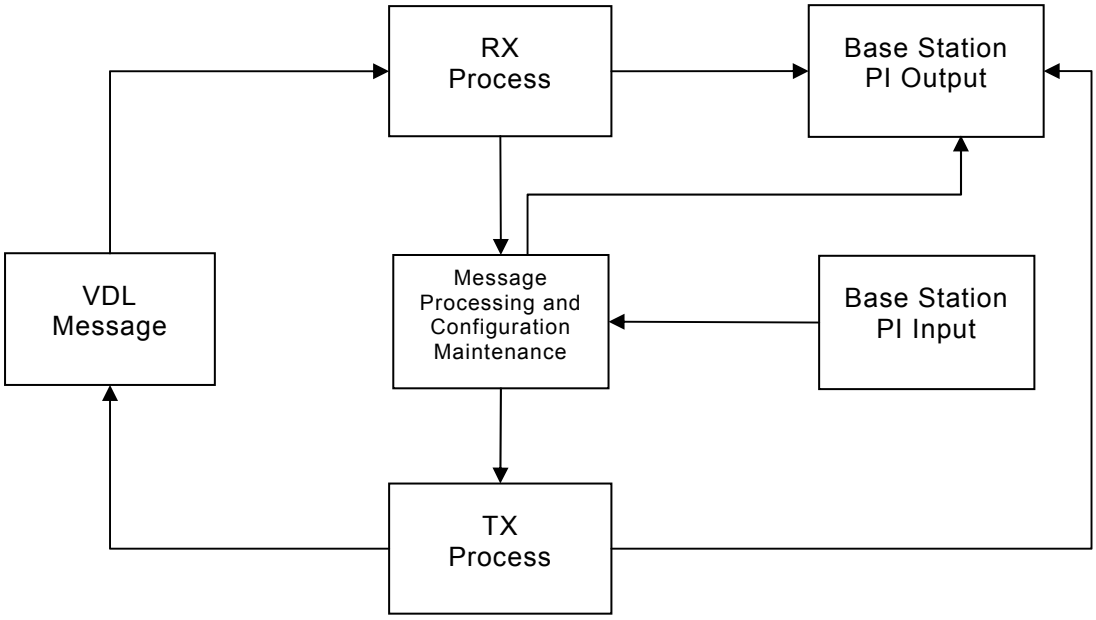

Figure 4 - General Processing Diagram

6.3.3 AIS Base Station Response to PI Input

The AIS Base Station shall respond to input sentences from the PI in accordance with Table 1, “Output Independent” when operating as an independent Base Station.

6.3.3.1 Requirements for Configuration of FATDMA Access Scheme (Link Management Message)

Use of FATDMA is reserved for Base Stations operating as either dependent or independent.

6.3.3.1.1 Slot Reuse

A Base Station report (Message 4) protects its slot usage by reservation of slots and the 120 NM rule. Slots allocated or used by Base Stations should not be used unless the Base Station is located over 120 NM from another Base Station. (ITU-R M.1371-1 A2, 4.4.1)

6.3.3.1.2 Configuration of Data Link Management Messages

The Data Link Management Message (Message 20) is a continuously scheduled and transmitted message. The Data Link Management message applies only to the frequency channel on which it is transmitted.

The Data Link Management Message shall be used by Base Station(s) to pre-announce the fixed allocation schedule (FATDMA) for one or more Base Station(s) and it shall be repeated as often as required.

The AIS Base Station shall use the CBM sentence to schedule the autonomously and continuously transmission of Data Link Management Messages, which refresh the FATDMA reservations.

6.3.4 AIS Base Station Interaction on the VDL

The interaction of the AIS Base Station on the VDL is presented in Table 7

Table 7 - Base Station response to input messages from the VDL

VDL Input	Resulting PI Output	Resulting VDL Output	Resulting VDL reporting rate
Any message (regardless of MMSI)	VDM, VSI**	Nil	Nil
Message 6 own MMSI	VDM, VSI**, VDO	Message 7	Once
Message 7 own MMSI	VDM, VSI**, ABK	Nil	Nil
Message 10 own MMSI	VDM, VSI**, VDO	Message 4	Once
Message 12 own MMSI	VDM, VSI**, VDO	Message 13	Once
Message 13 own MMSI	VDM, VSI**, ABK	Nil	Nil
Message 15 own MMSI	VDM, VSI**, VDO	Message 4, 17, 20, 22, or 23	Once*
Semaphore qualified	VDO, VSI**	Message 4	3-1/3 seconds
Not Semaphore qualified	VDO, VSI**	Message 4	10 seconds (see ITU-R M.1371-1 A2-3.1.3.3.1)

* If the AIS Base Station is set up for autonomous transmission of these messages, than the reply is on the next scheduled transmission. If the Base Station is not set up for autonomous tranmsision of message 4, then the Base Station shall respond within 4 seconds. If the Base Station is not set up for transmission of these messages, then there shall be no response.

** if VSI enabled.

6.3.4.1 Transmission of DGNSS Corrections

There are two possible ways to accept DGNSS corrections for transmission:

- As a result of a VDM sentence via the PI. All required information for transmission is included in the VDM sentence
- Via the dedicated optional DGNSS input port.

This standard provides tests for the VDM DGNSS corrections only.

6.3.4.2 Autonomous Base Station report Message 4

The independent Base Station shall periodically generate the Base Station report (Message 4) with a reporting interval of 10 s according to its given configuration. The Base Station shall operate in this state until it detects that it is required to operate as semaphore. The Base Station shall then increase its update rate of Message 4 to MAC SyncBaseRate (one report per 3 1/3 second). 3 min after the requirement for the Base Station to be semaphore has ceased it shall revert to the 10 s reporting interval.

6.3.4.3 Autonomous Tx of data link management messages

The DLM PI sentence shall be used to set up the link for use by the Base Station

6.3.4.4 Requirements for Acknowledgement / Retries Configuration

The number of retries for Addressed Messages as described in ITU-R M.1371-1, A2, §5.3.1 shall be input by configuration sentence BCF/BCE.

6.3.4.5 Requirements for Assigned Mode Commands

Assignment commands shall be transmitted by a Base Station when operating as a controlling entity. The Base Station shall be able to assign a specified transmission schedule to a mobile station.

The reporting rate assigned by a Base Station shall be, as a minimum, 20 reports per 10 minutes and, as a maximum, 1 report per second.

The Base Station shall be capable of assigning two mobile stations simultaneously.

6.3.4.6 Autonomous response to interrogation

When a Base Station receives a Message 15 from a mobile station, it shall automatically provide a single response with the message number indicated by the Message 15.

6.3.4.7 Requirements for the Preset of the Repeat-Indicator

The independent Base Station shall preset the repeat indicator for own transmissions of all VDL messages to a value between 0 and 3[2] in accordance with Recommendation ITU-R M.1371-1, A2, 4.6.1.2. If no configuration was received, the AIS Base Station shall use the default value of zero.

6.3.4.8 AIS Base Station response to VDM input

The Base Station shall transmit, on the VDL, VDM sentences received on the PI.

FATDMA shall be used as the access scheme for transmission. RATDMA may also be configured for use.

The following rules shall be used for VDL transmission:

- The VDL message shall be transmitted in pre-reserved FATDMA slots;
- If FATDMA slots are not available and if the Base Station has been configured to operate with RATDMA, then RATDMA shall be used;
- If RATDMA is not available, the next available FATDMA slot shall be used;
- If FATDMA and RATDMA are not available, there shall be no transmission.

6.3.4.9 Requirements for management of mobile AIS stations by AIS Base Station

The following operational settings for mobile AIS stations shall be controlled by an AIS Base Station:

a) Regional Area Designation
b) Regional Working Frequencies Assignment
c) Power level
d) Bandwidth
e) Tx/Rx mode
f) Transitional zone size
g) Reporting rate
h) Slot use (reservation)

6.3.5 Autonomous Channel Management

The sentence ACA shall be used to set up the channel management information for the AIS Base Station which shall result in transmission of Message 22.

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[2] By pre-set of the repeat indicator by non zero, the Base Station is disqualified from becoming an indirect sync source

6.4 BIIT Conditions

The AIS Base Station shall monitor the following BIIT conditions and shall generate the appropriate alarm and warning sentences on the PI. The alarm conditions are noted in table Table 8 and the Warning / Notification conditions are sent via PI sentence ADS.

Table 8 - BIIT Alarm conditions monitored by an AIS Base Station

Alarms description text	Alarm condition threshold exceeded	Alarm condition not exceeded	Alarm ID or text identifier	Reaction of the system to the alarm condition threshold exceeded
AIS: Tx malfunction	A	V	001	Stop transmission
AIS: Antenna VSWR exceeds limit	A	V	002	Continue operation
AIS: Rx channel A malfunction	A	V	003	Stop transmission on affected channel
AIS: Rx channel B malfunction	A	V	004	Stop transmission on affected channel
AIS: general failure	A	V	006	Stop transmission
AIS: No sensor position in use	A	V	026	Continue operation
AIS: Frame synchronisation failure	A	V	037	Stop transmission
AIS: DGNSS input failed [a]	A	V	038	Continue operation
[a] – optional	A – Alarm; V – Valid;			

6.5 Further Requirements for Optional Features

This section describes features that are optional for both dependent and independent operation of AIS Base Stations. If an option is selected, then the AIS Base Station shall comply with the requirements of the option selected, and this option shall be tested.

NOTE Tests for optional features are not included within this standard except fot the narrow band option.

6.5.1 Narrow Band Option

When the narrow band option (12,5 kHz) is implementd, the AIS Base Station shall comply with the additional requirements associated with 12,5 kHz as indicated in 5.1.

When the optional 12,5 kHz operating mode is implemented, the AIS Base Station shall be capable of changing bandwidth during normal operation.

6.5.2 External synchronisation source Option

The AIS Base Station may use an external synchronisation source via a dedicated input port. If used, the external synchronisation source shall have accuracy better than 52 μs.

The UTC synchronisation source in use shall be configurable by the sentence BCE.

The dedicated input port for external UTC synchronisation may consist of:

- pulse per second (PPS) detailed setting subject to configuration;
- UTC date and time

6.5.3 DGNSS Dedicated Port Option

The AIS Base Station may transmit DGNSS corrections (Message 17) as configured with ECB or CBM using dedicated RTCM SC104 format DGNSS port.

Base Stations shall convert the RTCM SC104 format to VDL format before transmission.

This option shall only be available for the independent operation.

7 Functional Definition of the Presentation Interface of the AIS Base Station

The Presentation Interface provides a method of communications for the Base Station. Also included in the PI sentences is a method for linking up to three sentences together.

7.1 Physical Requirements for the Presentation Interface

An interface shall be provided to handle the data bandwidth requirements of the PI.

7.2 Presentation Interface Data Exchange

Regardless of the physical interface used, the AIS Base Station shall exchange data using the sentences defined in IEC 61162-1 and Annex A. A linking method for linking up to three sentences has been provided in Annex A.2.

7.2.1 Base Station Presentation Interface Output

Table 1 includes the list of IEC 61162-1 output sentences.

All transmitted VDL messages shall be output by VDO sentences. The UTC hour, UTC minute (frame), and slot number of the slot or the first slot of a multi-slot message in which each VDL message was transmitted shall be provided by linking a VDO to a VSI sentence.

Each output sentence is identified by the Talker Identifier (first two characters of an IEC 61162-1 sentence) as configured by the BCF sentence.

7.2.2 Base Station Presentation Interface Input

Regardless of the physical interface implemented, the AIS Base Station shall accept data input conforming with IEC 61162-1. Table 1 lists the mandatory sentences for each type of Base Station.

8 Tests of AIS Base Stations - method of measurement and required results

NOTE Physical test parameters and testing subject to national requirements and may override parameters stated below. These parameters are stated as a guideline only.

8.1 Test conditions

8.1.1 Normal test conditions

8.1.1.1 Temperature and humidity

Temperature and humidity shall be within following range:

Temperature	+ 15° C to + 35° C
Humidity	20 % to 75 %

8.1.1.2 Power supply

The normal power supply for the tests shall be as specified by the manufacturer.

8.1.2 Extreme test conditions

The extreme temperature conditions are –15° C and +55° C. Where required, tests under extreme test conditions shall be a combination of:

- dry heat and upper limit of supply voltage applied simultaneously, and
- low temperature and lower limit of supply voltage applied simultaneously.

During type testing, the power source to the equipment may be replaced by a test power source, capable of producing normal and extreme test voltages.

8.1.3 Standard Test environment

The EUT is tested in an environment using test equipment to simulate and to log VDL messages. Standard environment consists of at least 5 simulated targets. The signal input level at the RF input port of the EUT for any simulated target shall be at least -100 dBm. Own position sensor inputs to the EUT will be simulated by the test system or other means.

Channels in use shall be selected by manual input before starting the tests.

8.1.4 Test Signals

8.1.4.1 Standard Test Signal Number 1

For TDMA Type 1: A test signal consisting of an infinite series of 010101

8.1.4.2 Standard Test Signal Number 2

For TDMA Type 2: A test signal consisting of an infinite series of 00110011.

NOTE Transmitters may have limitations concerning their maximum continuous transmit time and/or their transmission duty cycle. It is intended that such limitations be respected during testing.

8.1.4.3 Standard Test Signal Number 3

This test signal consistes of 200 packets grouped into clusters of 4 as described in Figure 5. Each cluster consists of 2 consecutive transmissions of packets. NRZI shall be applied to every packet. After sending packet 1 and 2, the initial state of the NRZI process shall be inverted and then packet 1 and 2 repeated.

Between every transmitted packet there shall be at least 2 free slots. The RF carrier shall be switched off between packets to simulate slotted behaviour.

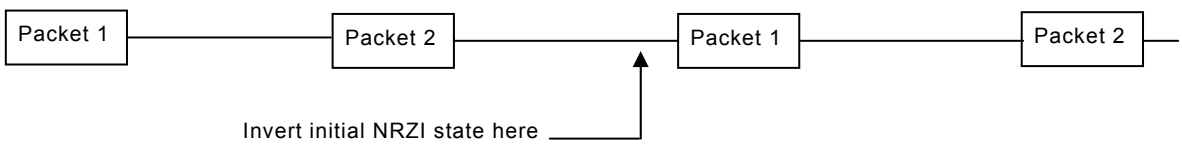

Figure 5 - Format for repeating four-packet cluster

Table 9 - Content of first two packets

Packet	Parameter	Bits	Contents	Comment
1	Training	24	0101....0101	
	Start flag	8	01111110	
	Data	168	Pseudo Random	As per Table 10
	CRC	16	Calculated	
	End flag	8	01111110	
2	Training	24	1010....1010	
	Start flag	8	01111110	
	Data	168	Pseudo Random	As per Table 10
	CRC	16	Calculated	
	End flag	8	01111110	

Table 10 - Fixed PRS data derived from ITU/T.0.153

Address	Contents (HEX)							
0-7	0x04	0xF6	0xD5	0x8E	0xFB	0x01	0x4C	0xC7
	0000.0100	1111.0110	1101.0101	1000.1110	1111.1011	0000.0001	0100.1100	1100.0111
8-15	0x76	0x1E	0xBC	0x5B	0xE5	0x92	0xA6	0x2F
	0111.0110	0001.1110	1011.1100	0101.1011	1110.0101	1001.0010	1010.0110	0010.1111
16-20	0x53	0xF9	0xD6	0xE7	0xE0	21 Byte's = 168 bits (+ 4 stuffed bits) , CRC = 0x3B85		
	0101.0011	1111.1001	1101.0110	1110.0111	1110.0000			

8.1.5 Arrangements for test signals applied to the receiver input

Sources of test signals for application to the receiver input shall be connected in such a way that the source impedance presented to the receiver input is 50 Ω.

The impedence shall be met irrespective of whether one or more signals using a combining network are applied to the receiver simultaneously.

The levels of the test signals at the receiver input terminals (RF socket) shall be expressed in terms of dBm.

The effects of any intermodulation products and noise produced in the test signal sources shall be negligible.

8.1.6 Encoder for receiver measurements

Whenever needed, and in order to facilitate measurements on the receiver, an encoder for the data system shall accompany the EUT, together with details of the normal modulation process. The encoder is used to modulate a signal generator for use as a test signal source.

Complete details of all codes and code format(s) used shall be given.

8.1.7 Waiver for receivers

If the manufacturer declares that both TDMA receivers are identical, the test shall be limited to one receiver and the test for the second receiver shall be waived. The test report shall include this.

8.1.8 Impedance

In this standard the term "50 Ω" is used for a 50 Ω non-reactive impedance.

8.1.9 Artificial antenna (dummy load)

Tests shall be carried out using an artificial antenna, which shall be a non-reactive, non-radiating load of 50 Ω connected to the antenna connector.

NOTE Some of the methods of measurement described in this standard for the transmitters allow for two or more different test set ups in order to perform those measurements. The corresponding figures illustrate one particular test set up, and are proivded as examples. In many of the figures, power attenuators (providing a non-reactive, non-radiating load of 50 Ω to the antenna connector) have been shown. These attenuators are not "artificial antennas". The method of measurement used shall be stated in the test report.

8.1.10 Facilities for access

All tests shall be performed using the standard ports of the EUT. Where access facilities are required to enable any specific test, these shall be provided by the manufacturer.

8.1.11 Operation of the transmitter

For the purpose of the measurements according to this standard, there shall be a facility to operate the transmitter unmodulated.

Alternatively, the method of obtaining an unmodulated carrier or special types of modulation patterns may also be decided by agreement between the manufacturer and the test laboratory. The method used shall be described in the test report and may involve suitable temporary internal modifications of the equipment under test.

NOTE For example, in the case of direct Frequency Shift Keying (FSK), a means to continuously transmit a sequence containing only "zeros" and a sequence containing only "ones" is preferable.

8.1.12 Measurement uncertainties

Maximum values of absolute measurement uncertainties shall are identified in Table 11.

Table 11 – Maximum values of absolute measurement uncertainties

RF frequency	± 1 x 10^{-7}
RF power	± 0,75 dB
Adjacent channel power	± 5 dB
Conducted spurious emission of transmitter	± 4 dB
Conducted spurious emission of receiver	± 3 dB
Two-signal measurement	± 4 dB
Three-signal measurement	± 3 dB
Radiated emission of transmitter	± 6 dB
Radiated emission of receiver	± 6 dB
Transmitter attack time	± 20 %
Transmitter release time	± 20 %
Transmitter transient frequency (frequency difference)	± 250 Hz

For the test methods according to this standard, these uncertainty figures are valid to a confidence level of 95 %.

The interpretation of the results recorded in a test report for the measurements described in this standard shall be as follows:

- the measured value related to the corresponding limit shall be used to decide whether equipment meets the requirements of this standard;
- the actual measurement uncertainty of the test laboratory carrying out the measurements, for each particular measurement, shall be included in the test report;
- the values of the actual measurement uncertainty shall be, for each measurement, equal to or lower than the figures given in this clause (absolute measurement uncertainties)

9 Physical Radio Tests

NOTE 12,5 kHz operation is optional.

9.1 Transceiver Protection Test

9.1.1 Purpose

This test demonstrates that the transceiver is properly protected against malfunction due to faults in the antenna system. This shall be the first test applied to the EUT.

9.1.2 Method of Measurement

While the transmitter is transmitting at the highest output power, the antenna port shall first be short-circuited and then open-circuited, in each case for a period of 5 min.

The EUT shall transmit 225 single slot messages evenly spread across the 5 min period during the short circuit condition and the open circuit condition.

NOTE A method for transmitting these messages shall be provided by the manufacturer.

9.1.3 Required results

The proof that the transceiver is protected against malfunctions at the antenna terminal is substantiated by the ability to pass the remainder of the tests in this section.

9.2 TDMA Transmitter

Unless otherwise stated, all transmitter tests shall be performed at the highest power setting.

9.2.1 Frequency Error at 25 kHz Operation

9.2.1.1 Purpose

The frequency error of the transmitter is the difference between the measured carrier frequency in the absence of modulation and its required frequency.

9.2.1.2 Method of measurement

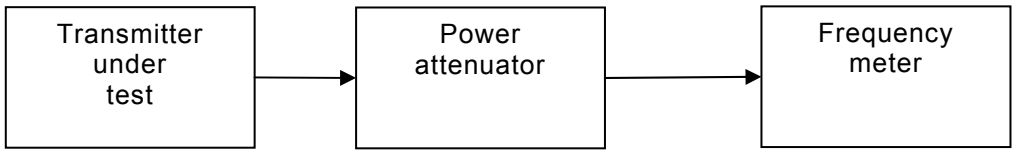

Figure 6 - Measurement arrangement

a) The equipment shall be connected as illustrated in Figure 6.

b) The carrier frequency shall be measured in the absence of modulation.

c) The measurement shall be made under normal test conditions and extreme test conditions.

d) The test shall be performed at 156,025 MHz and 162,025 MHz.

9.2.1.3 Required results

The frequency error shall not exceed ± 0,5 kHz, under normal test conditions and ± 1 kHz under extreme test conditions.

9.2.2 Frequency Error at optional 12,5 kHz operation

9.2.2.1 Purpose

The frequency error of the transmitter is the difference between the measured carrier frequency in the absence of modulation and its required frequency.

9.2.2.2 Method of measurement

Use the method of 9.2.1 while substituting the frequencies in step d) with 157,4125 MHz and 160,6375 MHz.

9.2.2.3 Required results

The frequency error shall not exceed ± 0,5 kHz, under normal test conditions and ± 1 kHz under extreme test conditions.

9.2.3 Carrier Power

9.2.3.1 Purpose

The transmitter carrier power conducted (P_c) is the mean power delivered to a nominal 50 Ω load during a radio frequency cycle. The rated nominal high power setting shall be 12,5 W and the rated nominal low power setting shall be 2 W. If Administrations desire different nominal power settings, the carrier power accuracy shall be tested at all settings.

9.2.3.2 Method of measurement

a) The equipment shall be connected as illustrated in Figure 7.

b) The carrier power shall be measured in the absence of modulation.

c) The measurement shall be made under normal test conditions and extreme test conditions.

d) The test shall be performed at 156,025 MHz and 162,025 MHz.

e) The carrier power accuracy shall be tested at all settings.

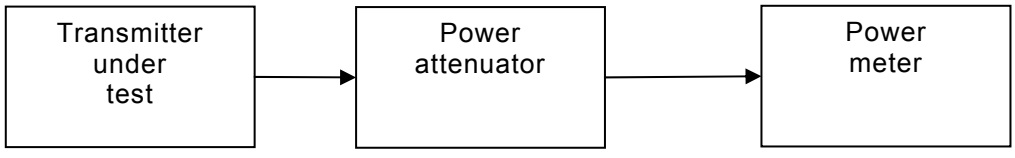

Figure 7 - Measurement arrangement

9.2.3.3 Required results

P_c shall be within ± 1,5 dB of the rated carrier power conducted.

P_c under extreme test conditions shall be within ± 3 dB of the rated carrier power conducted.

9.2.4 Modulation Spectrum Slotted Transmission for 25 kHz Channel

9.2.4.1 Purpose

This test is to ensure that the modulation sidebands produced by the specified test patterns fall within the allowable masks.

9.2.4.2 Method of measurement

a) The EUT shall be connected to a spectrum analyser.

b) The test shall be carried out using slotted transmission of test signal number 1

c) A minimum resolution bandwidth of 300 Hz and video bandwidth of 3 kHz and positive peak detection (max hold) shall be used for this measurement.

d) A sufficient number of sweeps and transmission packets shall be measured to ensure that the emission profile is developed.

e) Repeat steps a) through d) using test signal number 2

f) Tests shall be performed at 156,025 MHz and 162,025 MHz.

9.2.4.3 Required results

The modulation spectrum shall be within the mask detailed in Figure 8.

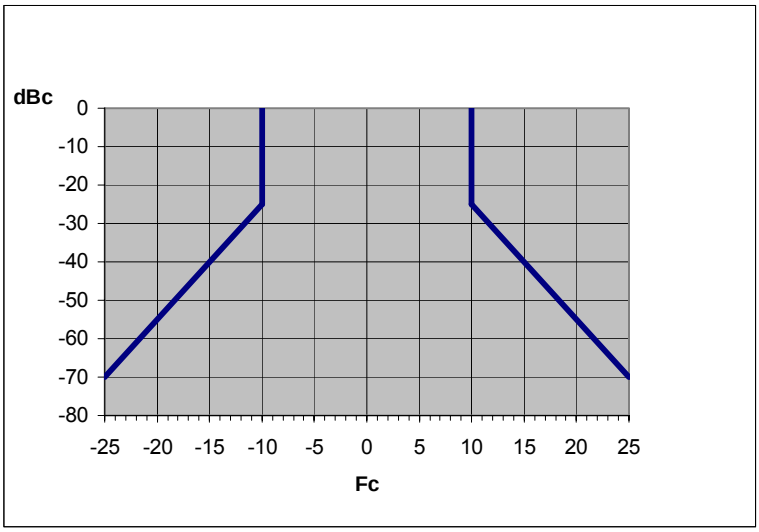

Figure 8 - Modulation Spectrum for Slotted Transmission 25 kHz

The emission mask for 25 kHz channel mode is:

At ± 10 kHz removed from the carrier, the modulation sidebands are below - 25 dBc.

At ± 25 kHz removed from the carrier, the modulation sidebands are below - 70 dBc, with no need to be below – 36 dBm.

In the region between ± 10 kHz and ± 25 kHz removed from the carrier, the modulation sidebands shall be below a line specified between these two points.

9.2.5 Modulation Spectrum Slotted Transmission at Optional 12,5 kHz Channel

9.2.5.1 Purpose

This test is to ensure that the modulation sidebands produced by the specified test patterns fall within the allowable masks.

9.2.5.2 Method of measurement

a) The EUT shall be connected to a spectrum analyser.

b) The test shall be carried out using slotted transmission of test signal number 1.

c) A minimum resolution bandwidth of 300 Hz and video bandwidth of 3 kHz and positive peak detection (max hold) shall be used for this measurement.

d) A sufficient number of sweeps and transmission packets shall be measured to ensure that the emission profile is developed.

e) Repeat steps a) through d) using test signal number 2

f) Tests shall be performed at 157,4125 MHz and 160,6375 MHz.

9.2.5.3 Required results

The modulation spectrum shall be within the mask detailed in Figure 9.

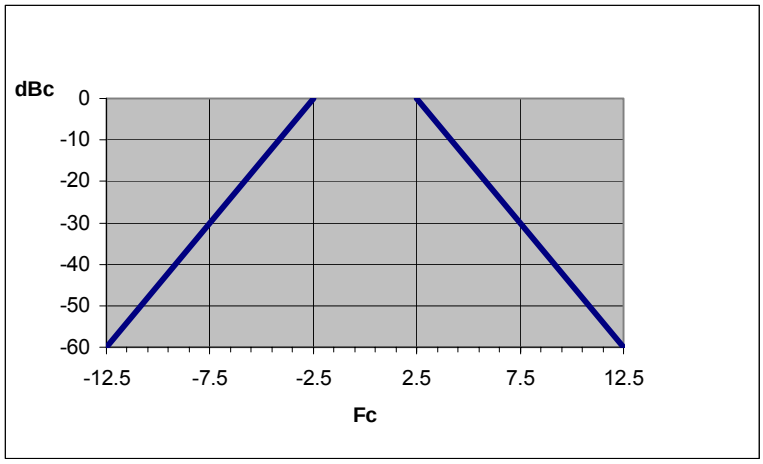

Figure 9 - Modulation Spectrum for Slotted Transmission at Optional 12,5 kHz

The emission mask for 12,5 kHz channel mode is:

At ± 12,5 kHz removed from the carrier, the modulation sidebands are below – 60 dBc

In the region between ± 2,5 kHz and ± 12,5 kHz removed from the carrier, the modulation sidebands are below a line starting at 0 dBc / ± 2,5 dBc and ending at – 60 dBc / ± 12,5 kHz with no need to be below – 36 dBm.

9.2.6 Transmitter Test Sequence and Modulation Accuracy Verification for 25 kHz operation

9.2.6.1 Purpose

The test is to verify that the training sequence starts with a 0 and is a 0101 pattern of 24 bits. The peak frequency deviation is derived from the baseband signal to verify modulation accuracy.

9.2.6.2 Method of measurement

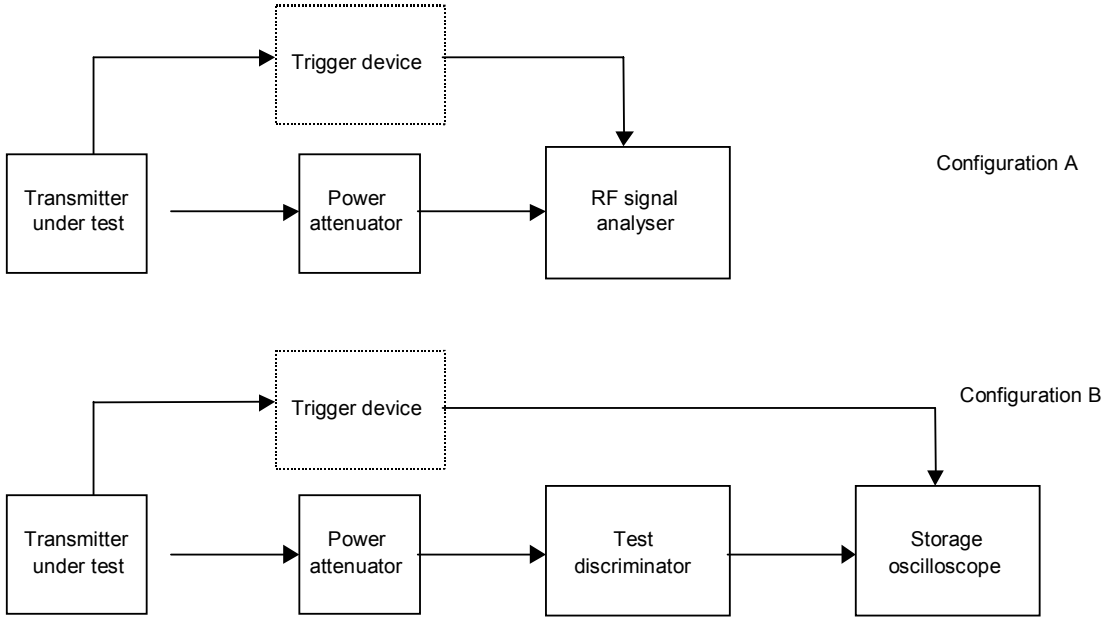

Figure 10 - Measurement arrangement for modulation accuracy

The measurement procedure shall be as follows:

a) The equipment shall be connected in either configuration A or configuration B as shown.

b) The trigger device is optional if the equipment is capable of synchronising to the transmitted bursts.

c) The transmitter shall be tuned to 156,025 MHz.

d) The transmitter shall be modulated with test signal number 1.

e) The deviation from the carrier frequency shall be measured as a function of time.

f) Repeat steps a) through e) with test signal number 2.

g) Measurement shall be repeated at 162,025 MHz.

9.2.6.3 Required results

For test signal number 1: The training sequence shall start with a ‘0’ bit and, the peak frequency deviation shall be 2400 Hz ± 240 Hz.

For test signal number 2: The peak frequency deviation shall be 1200 Hz ± 120 Hz.

9.2.7 Transmitter Test Sequence and Modulation Accuracy Verification for 12,5 kHz operation

9.2.7.1 Purpose

The test is to verify that the training sequence starts with a 0 and is a 0101 pattern of 24 bits. The peak frequency deviation is derived from the baseband signal to verify modulation accuracy.

9.2.7.2 Method of measurement

Follow the measurement method in 9.2.6.

9.2.7.3 Required results

For test signal number 1: The training sequence shall start with a ‘0’ bit and the peak frequency deviation shall be 2400 Hz ± 240 Hz.

For test signal number 2: The peak frequency deviation shall be 1200 Hz ± 120 Hz.

9.2.8 Transmitter output power versus time function

9.2.8.1 Definition

Transmitter output power versus time function is a combination of the transmitter delay, attack time, release time and transmission duration as defined in Table 12 where:

a) Transmitter delay time (T_A -To) is the time between the start of the slot and the moment when the transmit power exceeds –50dB of the steady-state power (P_{ss})

b) Transmitter attack time (T_{B2} - T_A) is the time between the transmit power exceeding -50dBc and the moment when the transmit power maintains a level within + 1,5 dB - 1dB from P_{ss}.

c) Transmitter release time (T_F - T_E) is the time between the end flag being transmitted and the moment when the transmitter output power has reduced to a level 50 dB below P_{ss} and remains below this level thereafter.

d) Transmission duration (T_F - T_A) is the time from when power exceeds - 50 dBc to when the power returns to and stays below - 50 dBc.

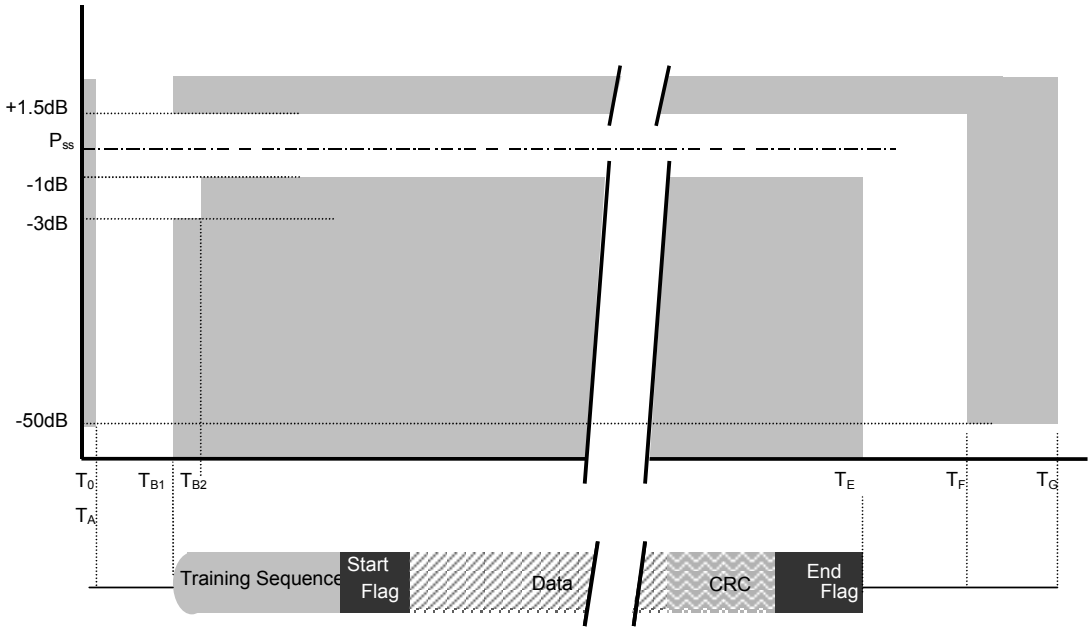

Figure 11 - Power versus time mask

Table 12 - Definition of timings for Figure 11

Reference		bits	Time	Definition
T_0		0	0 ms	Start of transmission slot. Power shall NOT exceed –50 dB of P_{ss} before To
T_A		0-6	0-0.624 ms	Power exceeds –50 dB of P_{ss}
T_B	T_{B1}	6	0.624 ms	Power shall be within +1,5 or -3 dB of P_{ss}
	T_{B2}	8	0.8324 ms	Power shall be within +1,5 or -1 dB of P_{ss}
T_E (includes 1 stuffing bit)		231	24.024 ms	Power shall remain within +1,5 or -1 dB of P_{ss} during the period T_{B2} to T_E
T_F (includes 1 stuffing bit)		239	26.146 ms	Power shall be -50 dB of P_{ss} and stay below this
T_G		256	26.624 ms	Start of next transmission time period

There shall be no modulation of the RF after the termination of transmission (T_E) until the power has reached zero and next slot begins (T_G).

9.2.8.2 Method of measurement

a) The measurement shall be carried out by transmitting test signal number 2 (note that this test signal generates one additional stuffing bit within its CRC portion).

b) The EUT shall be connected to a spectrum analyser. A resolution bandwidth of 1 MHz, video bandwidth of 1 MHz and a sample detector shall be used for this measurement. The analyser shall be in zero-span mode for this measurement.

c) For the purposes of this test the EUT shall be equipped with a test signal (SYNC) indicating the start of each time period that it intends to transmit into. This will be used as a trigger source for the spectrum analyser. The SYNC signal shall be aligned to the nominal start time (T_0) of the transmission time period.

d) Tests shall be performed on the lowest operating frequency on which the EUT can transmit according the manufacturers specification and AIS2 (162,025 MHz).

9.2.8.3 Required result

The transmitter power shall remain within the mask shown in Figure 11 and associated timings given in Table 12.

9.2.9 Intermodulation attenuation

9.2.9.1 Purpose

The intermodulation attenuation is a measure of the capability of a transmitter to inhibit the generation of signals caused by the presence of the carrier and an interfering signal entering the transmitter via its antenna.

9.2.9.2 Method of Measurement

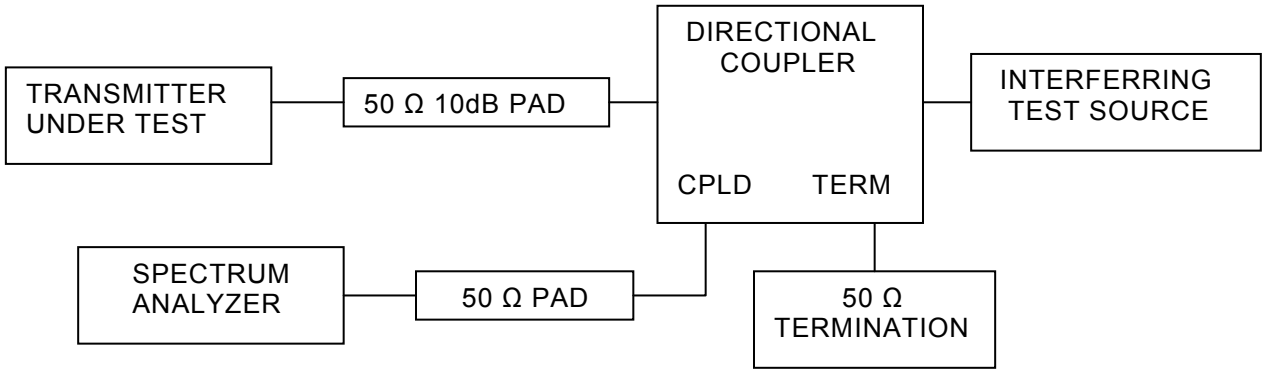

Figure 12 - Measurement arrangement

The measurement arrangement shown in Figure 12 shall be used.

a) The transmitter shall be connected to a 50 Ω 10 dB power attenuator and via a (directional) coupler to a spectrum analyser. An additional attenuator may be required between the directional coupler and the spectrum analyser to avoid overloading.

b) In order to reduce the influence of mismatch errors it is important that the 10 dB power attenuator is coupled to the transmitter under test with the shortest possible connection.

c) The interfering test signal source shall be either a transmitter providing the same power output as the transmitter under test and be of a similar type, or a signal generator and a linear power amplifier capable of delivering the same output power as the transmitter under test.

d) The (directional) coupler shall have an insertion loss of less than 1 dB. If a directional coupler is used, it shall have a directivity of at least 20 dB.

e) The transmitter under test and the test signal source shall be physically separated so that the measurement is not influenced by direct radiation.

f) The transmitter under test shall be unmodulated and the spectrum analyser adjusted to a span of 500 kHz. The transmitter under test shall be set to continuous transmission mode.

g) The interfering test signal source shall be unmodulated and its frequency shall be within 50 kHz to 100 kHz above the frequency of the transmitter under test. The frequency shall be chosen in such a way that the intermodulation components to be measured do not coincide with other spurious components.

h) The power output of the interfering test signal source shall be adjusted to the carrier power level of the transmitter under test.

i) The ratio of the largest third order intermodulation component with respect to the carrier shall be measured on the spectrum analyser and recorded.

j) This measurement shall be repeated with the interfering test signal source at a frequency within 50 kHz to 100 kHz below the frequency of the transmitter under test.

k) The intermodulation attenuation of the equipment under test shall be expressed as the lower of the two values recorded in above.

9.2.9.3 Required results

The intermodulation ratio shall be not less than 40 dB.

9.3 TDMA Receivers

9.3.1 Sensitivity for 25 kHz Operation

9.3.1.1 Purpose

The maximum usable sensitivity (data or messages, conducted) is the minimum signal level at the receiver input, produced by a carrier at the specified frequency of the receiver, modulated with the specified test signal, which will, without interference, produce a data signal with a specified packet error rate (PER) after demodulation.

9.3.1.2 Method of measurement

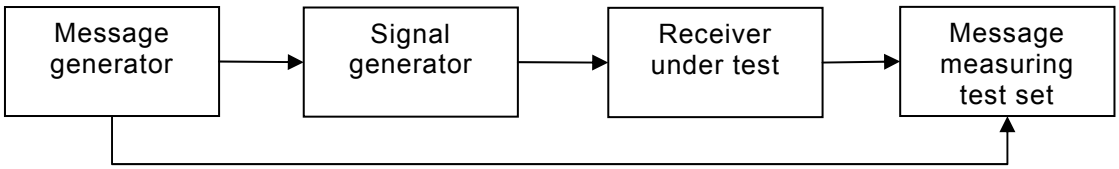

Figure 13 - Measurement arrangement

a) The equipment shall be connected as illustrated in Figure 13.

b) The signal generator shall be set to – 107 dBm

c) Use test signal number 3

d) The test shall be performed at 156,025 MHz and 162,025 MHz

e) A minimum of 200 packets shall be transmitted during the test

f) Repeat the test under extreme conditions with the signal generator level set to - 101 dBm.

9.3.1.3 Required results

Minimum PER of 20 %

9.3.2 Sensitivity for optional 12,5 kHz Operation

9.3.2.1 Purpose

The maximum usable sensitivity (data or messages, conducted) is the minimum signal level at the receiver input, produced by a carrier at the specified frequency of the receiver, modulated with the normal test signal, which will, without interference, produce a data signal with a specified packet error rate (PER) after demodulation.

9.3.2.2 Method of measurement

Use the method detailed in 9.3.1 with the following settings:

a) Signal generator level shall be – 98 dBm for normal conditions and shall be - 92 dBm for extreme conditions.

b) The test shall be performed at 157,4125 MHz and 160,6375 MHz.

9.3.2.3 Required result

Minimum PER of 20 %.

9.3.3 Error Behaviour at High Input Levels

9.3.3.1 Purpose

The error behaviour (performance) at high input levels is defined in the same manner as for the measurement of the maximum usable sensitivity when the level of the wanted signal is 100 dB above the maximum wanted sensitivity.

9.3.3.2 Method of measurement

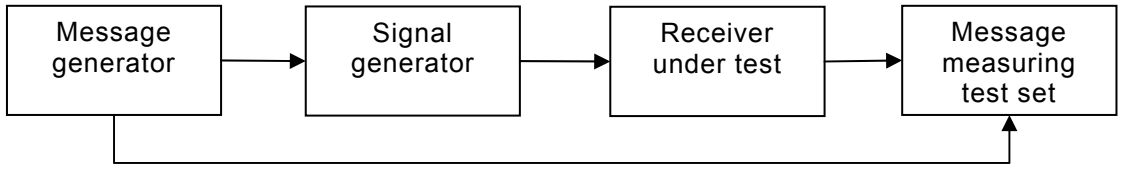

Figure 14 - Measurement arrangement

The measurement procedure shall be as follows:

a) An input signal set to 161,975 MHz, modulated with test signal number 3 shall be applied to the receiver

b) The level of the input signal shall be adjusted to – 77 dBm

c) 200 packets shall be transmitted and the PER shall be calculated

d) The measurement shall be repeated with the input signal at – 7 dBm.

9.3.3.3 Required results

The PER shall not exceed 1% in either case.

9.3.4 Co-Channel Rejection for 25 kHz Operation

9.3.4.1 Purpose

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due the presence of an unwanted modulated signal, both signals being at the specified frequency of the receiver.

9.3.4.2 Method of measurement

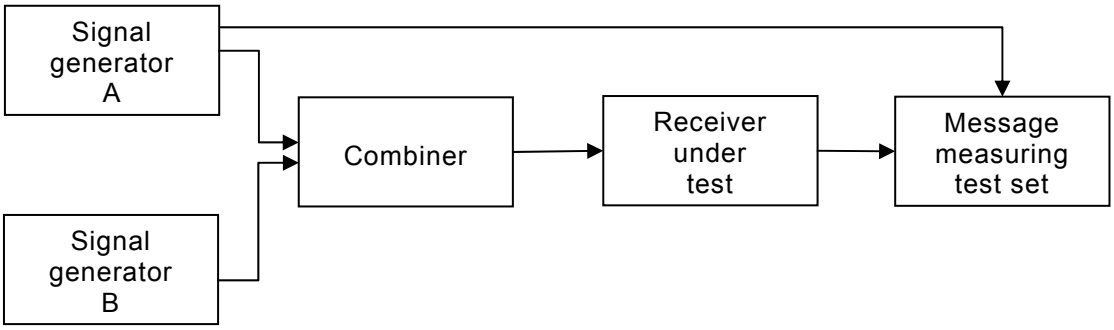

Figure 15 - Measurement arrangement

The measurement procedure shall be as follows:

a) Two generators A and B, shall be connected to the receiver via a combining network.

b) The wanted signal, provided by signal generator A, shall be at the specified frequency of the receiver and shall be modulated to generate test signal number 3

c) The unwanted signal, provided by generator B, shall also be at the specified frequency of the receiver. Generator B shall be frequency modulated to a depth of ± 3 kHz at a rate of 400 Hz.

d) The level of the wanted signal from generator A shall be adjusted to - 104 dBm.

e) The level of the unwanted signal from generator B shall be adjusted to - 114 dBm.

f) The message measuring test set shall be monitored and the packet error rate observed over 200 transmissions.

g) The test shall be carried out at a specified frequency of 156,025 MHz and 162,025 MHz.

9.3.4.3 Required result

The PER shall not exceed 20 %.

9.3.5 Co-Channel Rejection for optional 12,5 kHz Operation

9.3.5.1 Purpose

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due the presence of an unwanted modulated signal, both signals being at the specified frequency of the receiver.

9.3.5.2 Method of measurement

Use the method of section 9.3.4 with the wanted signal generator level set to - 95 dBm and the unwanted signal generator level to - 113 dBm. Also, the modulation depth of the unwanted signal generator shall be set to ± 1,5 kHz.

9.3.5.3 Required result

The PER shall not exceed 20 %.

9.3.6 Adjacent Channel selectivity for 25 kHz Operation

9.3.6.1 Purpose

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of

an unwanted signal which differs in frequency from the wanted signal by an amount equal to the adjacent channel separation for which the equipment is intended.

9.3.6.2 Method of measurement

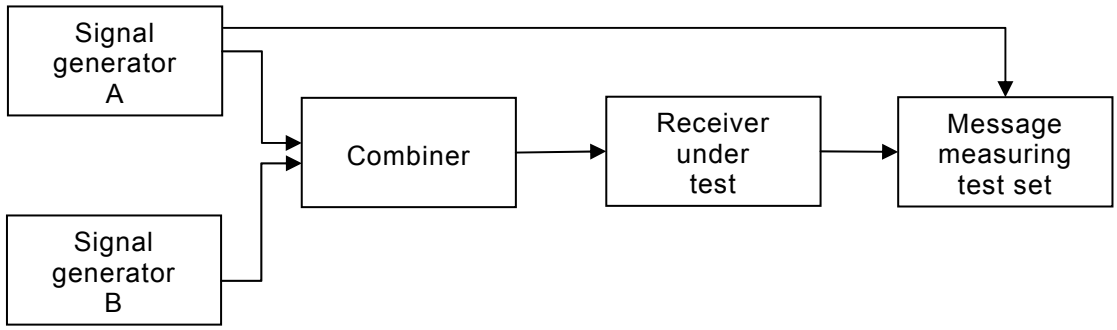

Figure 16 - Measurement arrangement

The measurement procedure shall be as follows:

a) Two generators A and B, shall be connected to the receiver via a combining network.

b) The wanted signal, provided by signal generator A, shall initially be at 156,025 MHz and be modulated to generate test signal number 3.

c) The unwanted signal, provided by generator B, shall be frequency modulated with a 400 Hz sine wave giving a deviation of ± 3 kHz. Generator B shall be at a frequency 25 kHz above that of the wanted signal.

d) The level of the wanted signal from generator A shall be adjusted to a level of - 104 dBm.

e) The level of the unwanted signal from generator B shall be adjusted to – 34 dBm.

f) The message measuring test set shall be monitored and the PER observed over 200 transmissions.

g) Repeat the above measurement with the unwanted signal 25 kHz below the wanted signal.

h) Repeat the whole test Steps a) to g) at 162,025 MHz

9.3.6.3 Required results

The PER shall not exceed 20 %.

9.3.7 Adjacent Channel selectivity for optional 12,5 kHz Operation

9.3.7.1 Purpose

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted signal which differs in frequency from the wanted signal by an amount equal to the adjacent channel separation for which the equipment is intended.

9.3.7.2 Method of measurement

Use the method in 9.3.6 but substitute - 95 dBm for the level of the wanted signal generator and - 45 dBm for the level of the unwanted signal generator. Also, the modulation depth of the unwanted signal generator shall be set to ± 1,5 kHz

9.3.7.3 Required results

The PER shall not exceed 20 %

9.3.8 Spurious Response Rejection

9.3.8.1 Purpose

The spurious response rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal at any other frequency, at which a response is obtained.

9.3.8.2 Manufacturers' declarations

The manufacturer shall declare the following in order to calculate the "Limited Frequency Range" over which the initial part of the test will be performed:

a) List of intermediate frequencies (IF1, IF_2, ...$IF_{N)}$ in Hz

b) Switching range of the receiver[3] (sr)

c) Frequency of the local oscillator[4] at AIS2 and at the lowest TDMA channel (f_{LOH}, $f_{LOL)}$

9.3.8.3 Introduction to the Method of measurement

The initial evaluation of the EUT shall be performed over the "Limited Frequency Range" and shall then be performed at the frequencies identified from this test and at "Specific Frequencies of Interest" (as defined below).

To determine the frequencies at which spurious responses can occur the following calculations shall be made:

9.3.8.4 Calculation of the "Limited Frequency Range":

The limits of the limited frequency range (LFR_{HI} LFR_{LO}) are determined from the following calculations:

LFRHI = fLOH + (IF1 + IF2 +...+IFN + sr/2)

LFRLO = fLOL - (IF1 + IF2 +...+IFN + sr/2)

Calculation of Specific Frequencies of Interest (SFI) outside the limited frequency range:

These are determined by the following calculations:

SFI1 = (K * fLOH) + IF1

SFI2 = (K * fLOL) - IF1

Where K is an integer from 2 to 4

9.3.8.5 Method of measurement over the Limited Frequency Range

Two methods are available for the measurements over the Limited Frequency Range, one based on SINAD measurements and the other based on PER measurements. Either method may be used, but in each case shall be followed by the method of measurement at identified frequencies.

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[3] Switching range corresponds to the frequency range over which the receiver can be tuned.

[4] This may be a VCO, crystal, sampling clock, BFO, Numerically Controlled Oscillator depending on the design of the equipment.

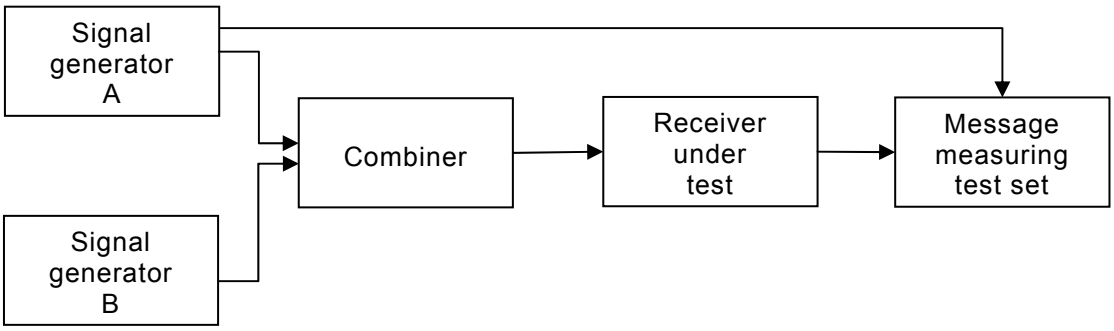


Figure 17 - PER/BER or SINAD Measuring Equipment

9.3.8.6 Method of search over the "Limited Frequency Range" using SINAD measurement

a) Two generators A and B shall be connected to the receiver via a combining network.

b) The wanted signal, provided by generator A, shall be at 161,975 MHz and shall be modulated with a 1 kHz sine wave at ± 2,4 kHz deviation.

c) The unwanted signal, provided by generator B, shall be frequency modulated with a 400 Hz sine wave giving a deviation of ± 3 kHz.

d) Initially, generator B (unwanted) shall be switched off (maintaining the output impedance).

e) The signal level from generator A (wanted) shall be adjusted to – 101 dBm at the receiver.

f) The SINAD value shall be noted (and shall be greater than 14 dB)

g) Signal generator B shall be switched on and adjusted to – 27 dBm at the receiver.

h) The frequency of the unwanted signal shall be varied in steps of 5 kHz over the Limited Frequency Range (from LFR_{LO} to LFR_{HI}).

i) The frequency of any spurious response detected (by an decrease in SINAD of 3 dB or more) during the search shall be recorded for use in the next measurement.

9.3.8.7 Method of search over the "Limited Frequency Range" using PER or BER measurement

a) Two generators A and B, shall be connected to the receiver via a combining network.

b) The wanted signal, provided by generator A, shall be at 161,975 MHz and shall be modulated to generate test signal number 3.

c) The unwanted signal, provided by generator B, shall be frequency modulated with a 400 Hz sine wave giving a deviation of ± 3 kHz.

d) Initially, generator B (unwanted) shall be switched off (maintaining the output impedance).

e) The signal level from generator A (wanted) shall be adjusted to - 101 dBm at the receiver.

f) The PER or BER shall be noted

g) Signal generator B shall be switched on and adjusted to – 27 dBm at the receiver.

h) The frequency of the unwanted signal shall be varied in steps of 5 kHz over the Limited Frequency Range (from LFR_{LO} to LFR_{HI})

i) The frequency of any spurious response detected (by an increase in either PER or BER) during the search shall be recorded for use in the next measurements.

j) In the case where operation using a continuous packet stream is not possible a similar method may be used.

9.3.8.8 Method of measurement (at Identified Frequencies)

a) Two generators A and B, shall be connected to the receiver via a combining network.

b) The wanted signal, provided by generator A, shall be at 161,975 MHz and shall be modulated to generate test signal number 3.

c) The unwanted signal, provided by generator B, shall be frequency modulated with a 400 Hz sine wave giving a deviation of ± 3 kHz. Generator B shall be at the frequency of that spurious response being considered.

d) Initially, generator B (unwanted) shall be switched off (maintaining the output impedance).

e) The signal level from generator A (wanted) shall be adjusted – 101 dBm at the receiver.

f) Generator B shall be switched on, and the level of the unwanted signal set to - 31 dBm

g) For each frequency noted during the tests over the Limited Frequency Range and the Specific Frequencies of Interest (SFI_1 and SFI_2), transmit 200 packets to the EUT and note the PER.

9.3.8.9 Required results

At any frequency separated from the specified frequency of the receiver by two channels or more, the PER shall not exceed 20 %.

9.3.9 Spurious response rejection for Optional 12,5 kHz Operation

9.3.9.1 Purpose

The spurious response rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal at any other frequency, at which a response is obtained.

9.3.9.2 Manufacturer's Declaration

Use the manufacturer's declaration stated in 9.3.8

9.3.9.3 Method of Measurement

Use the method of measurement detailed in 9.3.8 with the receiver frequency set to 157,4125 MHz

9.3.9.4 Required Results

At any frequency separated from the specified frequency of the receiver by two channels or more, the PER shall not exceed 20 %.

9.3.10 Intermodulation response rejection

9.3.10.1 Purpose

The intermodulation response rejection is the capability of the receiver to receive a wanted modulated signal, without exceeding a given degradation due to the presence of two close-spaced unwanted signals with a specific frequency relationship to the wanted signal frequency.

9.3.10.2 Method of test

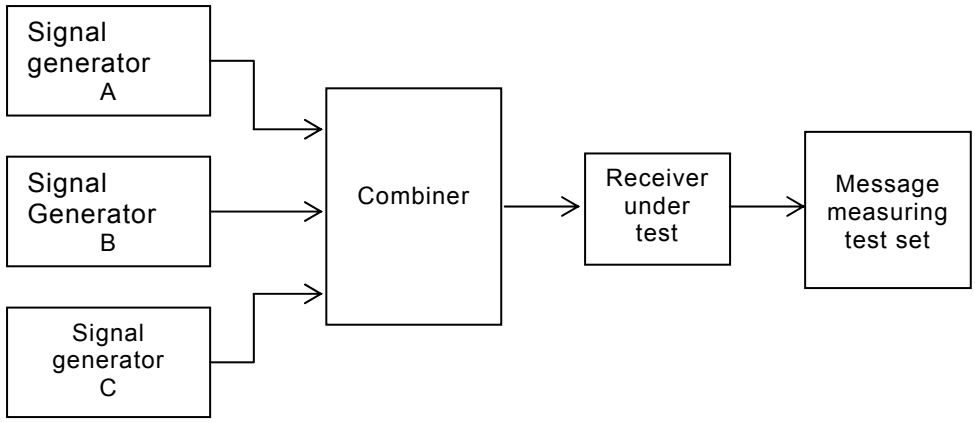


Figure 18 - Measurement arrangement for inter-modulation

The measurement procedure shall be as follows:

a) Three signal generators shall be connected to the receiver via a combining network.

b) The wanted signal, provided by signal generator A, shall be at the specified frequency of the receiver and shall be modulated to generate test signal number 3.

c) The unwanted signal from generator B shall be unmodulated.

d) The unwanted signal from generator C shall be frequency modulated with a 400 Hz sine wave at a deviation of ± 3 kHz.

e) The signal level from generator A (wanted) shall be set for – 101 dBm at the receiver input.

f) The signal level from generators B and C shall be set for – 27 dBm at the receiver input.

g) The frequencies of generators A, B, C shall be set as per test number 1 of Table 13.

h) The message measuring test set shall be monitored and the PER observed over 200 transmissions.

i) Repeat the measurement with frequencies set as per test number 2 of Table 13.

Table 13 - Frequencies for inter-modulation test

Test Number	**Generator A** Wanted AIS Signal	**Generator B** Unmodulated (+/- 500 kHz)	**Generator C** Modulated (+/- 1000 kHz)
1	162,025 MHz	161,525 MHz	161,025 MHz
2	156,025 MHz	156,525 MHz	157,025 MHz

9.3.10.3 Required results

The PER shall not exceed 20 %.

9.3.11 Blocking or Desensitisation

9.3.11.1 Purpose

Blocking is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted input signal at any frequency other than those of the spurious responses or the adjacent channels.

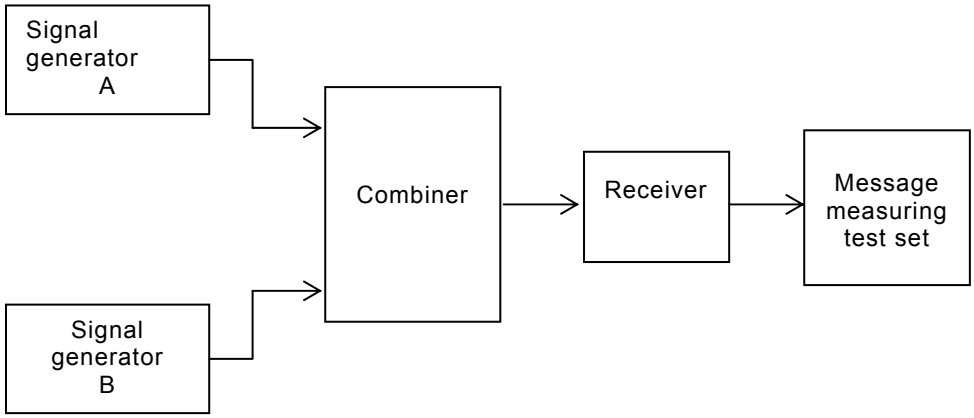


Figure 19 - Measurement Arrangement for Blocking or Desensitisation

9.3.11.2 Method of measurement

The measurement procedure shall be as follows:

a) Two generators A and B, shall be connected to the receiver via a combining network as shown in Figure 19.

b) The wanted signal, provided by signal generator A, shall be initially at 156,025 MHz and be modulated to generate test signal number 3.

c) The unwanted signal from generator B shall be unmodulated and tuned to 161,75 MHz. Initially, signal generator B (unwanted signal) shall be switched off (maintaining the output impedance). The level of the wanted signal from generator A shall be adjusted to - 101 dBm at the receiver input.

d) Generator B shall then be switched on, and the level of the unwanted signal set to - 15 dBm

e) 200 packets shall be transmitted and the PER recorded.

f) Repeat the test [Steps a) to e)] with the wanted signal generator tuned to 162,025 MHz and the unwanted signal generator tuned to 156,3 MHz.

9.3.11.3 Required results

The PER shall not exceed 20 %.

9.4 Conducted Spurious Emissions at the antenna

9.4.1 Spurious Emissions from the Receiver

9.4.1.1 Purpose

Conducted spurious emissions to the antenna are any RF emissions generated in the receiver and conveyed to the antenna terminal.

9.4.1.2 Method of measurement

Conducted spurious emissions shall be measured as the power level of any frequency component to the antenna terminals of the receiver. The receiver antenna terminals are connected to a spectrum analyser or selective voltmeter having an input impedance of 50 Ω and the receiver is switched on.

The measurement shall extend over the frequency range 9 kHz to 2 GHz.

9.4.1.3 Required results

The power of any spurious emission in the specified range at the antenna terminal shall not exceed - 57 dBm in the frequency range 9 kHz to 1 GHz and - 47 dBm in the frequency range 1 GHz to 2 GHz.

9.4.2 Spurious Emissions from the Transmitter

9.4.2.1 Purpose

Spurious emissions are emissions at frequencies other than those of the carrier and sidebands associated with normal modulation.

9.4.2.2 Method of measurement

Conducted spurious emissions shall be measured with the unmodulated transmitter connected to the artificial antenna. The measurement shall be made over a frequency range from 9 kHz to 2 GHz, excluding the channel on which the transmitter is operating and its adjacent channels.

9.4.2.3 Required results

The power of any spurious emission at any frequency shall not exceed - 36 dBm in the frequency range 9 kHz to 1 GHz and - 30 dBm in the frequency range 1 GHz to 2 GHz.

10 Functional tests for Base Station

This section identifies the functional tests for the Base Station. Validation of the Presentation Interface is integrated in the following tests. The tests are for all Base Stations. Some of the tests are not required if the Base Station is to be tested as a dependent unit only. These tests and results are indicated at the start of the test by a note.

10.1 Pre-Setup

NOTE The sentences provided in the Pre-Setup condition and through out this test section contain data fields as examples only. The xxxxxxx fields will be substituted with the manufacturer's electronic serial number.

For all tests the Pre-Setup conditions are:

a) The EUT will be given a SID sentence to set the Unique Identifier and MMSI to a known value.

$xxSID,xxxxxxxxxxxxxxxxxxxx,AA003770007,003770007,D*hh<CR><LF>

b) The EUT will be given a BCF sentence to set the following: position source to surveryed, LAT/LON position to a known location, position accuracy to high, channels to 2087 and 2088, transmitter power to high, messages retries to three, repeat indicator to three, and talker ID to AB.

$xxBCF,003770007,0,2959.9990,N,8359.9990,W,1,2087,2088,2087,2088,0,0,3,3,BS*hh<CR><LF>

c) The EUT will be given a BCE sentence to set RATDMA to zero (disabled).

$xxBCE,AA003770007,0,I,60*hh<CR><LF>

d) The EUT will be given a series of ECB sentences to disable all autonomous transmissions

$xxECB,AA003770007,4,0,-1,,,0,-1,,*hh<CR><LF>

$xxECB,AA003770007,17,0,-1,,,0,-1,,*hh<CR><LF>

$xxECB,AA003770007,20,0,-1,,,0,-1,,*hh<CR><LF>

$xxECB,AA003770007,22,0,-1,,,0,-1,,*hh<CR><LF>

$xxECB,AA003770007,23,0,-1,,,0,-1,,*hh<CR><LF>

e) The EUT will be given a SPO sentence to ensure all optional VDL information is disabled.

$xxSPO,AA003770007,N,0,0,0,0,0,0,0,0,0,0,0,*hh<CR><LF>

f) The EUT will be given a series of 20 DLM sentences to clear any FATDMA reservations.

$xxDLM,0,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,0,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,1,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,1,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,2,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,2,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,3,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,3,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,4,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,4,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,5,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,5,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,6,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,6,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,7,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,7,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,8,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,8,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,9,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,9,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

g) The standard test environment shall include 5 AIS mobile targets running on the default AIS channels 2087 and 2088 or appropriate test channels.

h) Normal mode for the EUT is EUT powered on, UTC available, both transmitters enabled and AIS channels set to 2087 and 2088 or appropriate test channels.

i) Record all messages on the VDL and record all messages on the PI

10.2 Normal Operation

10.2.1 Base Station configuration and services

10.2.1.1 Base Station Configuration

10.2.1.1.1 Purpose

The purpose of this test is to verify that the Base Station can be configured with an MMSI and Unique Identifier. This test verifies the EUTs correct response to these two SID data fields.

10.2.1.1.2 Method of Measurement

a) Query the EUT for the VER sentence.

$xxBSQ,VER*hh<CR><LF>

b) Apply the following SID sentence using the correct serial number:

$xxSID,xxxxxxxxxxxxxxxxxxxx,AA003660007,003660007,*hh<CR><LF>

Query the EUT for the VER sentence

$xxBSQ,VER*hh<CR><LF>

c) Apply the following SID sentence using an incorrect electronic serial number:

$xxSID,xxxxxxxxxxxxxxxxxxxx,AA003770007,003770007,*hh<CR><LF>

Query the EUT for the VER sentence.

$xxBSQ,VER*hh<CR><LF>

d) Apply the following SID sentence using the correct electronic serial number:

$xxSID,xxxxxxxxxxxxxxxxxxxx,AA003770007,003770007,*hh<CR><LF>

Query the EUT for the VER sentence.

$xxBSQ,VER*hh<CR><LF>

e) Apply the following SID sentence using the correct electronic serial number:

$xxSID,xxxxxxxxxxxxxxxxxxxx,AA003770007,003770007,E*hh<CR><LF>

Apply the following ECB sentence with an incorrect identifier and DLM sentence:

$xxECB,AA003770008,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

10.2.1.1.3 Required Results

a) Confirm the VER sentence structure and note the electronic serial number.

b) Confirm the content of the VER sentence and that the correct MMSI and Unique Identifier has been configured.

c) Confirm the content of the VER sentence and that the correct MMSI and Unique Identifier has been retained

d) Confirm the content of the VER sentence and that the new MMSI and Unique Identifier has been configured

e) Confirm that the ECB and DLM sentences were ignored, and the EUT remains as defined in the Pre-Setup Conditions.

10.2.1.2 Base Station Report Information content and Reporting Rate

10.2.1.2.1 Purpose

This test verifies the basic functionality of a Base Station. This test will verify the “Pre-Setup condition” used in subsequent testing.

10.2.1.2.2 Method of measurement

a) Set-up standard test environment and apply the BCF, BCE, ECB, SPO and DLM sentences to the EUT as defined in the Pre-Setup conditions.

b) Apply a TSA sentence and a VDM sentence with encapsulated Message 4 to the EUT.

$xxTSA,AA003770007,9,A,HHMMSS,1050,1,2*hh<CR><LF>

!xxVDM,1,1,9,A,40C4qnh00041?G1RMfL0tJi004P4,0*hh<CR><LF>

c) Apply the following BBM sentence to the EUT

$xxBBM,1,1,0,0,14,D5CDP=5CC175,0*hh<CR><LF>

NOTE The following tests are required for a Base Station operated as an independent unit.

d) Apply the following DLM sentence to the EUT.

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

e) Apply the following ECB sentence to the EUT.

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

f) Apply the following SPO sentence to the EUT.

$xxSPO,AA003770007,A,1,1,1,,1,,,1,1,1,1*hh<CR><LF>

10.2.1.2.3 Required results

a) Confirm that the BCF, BCE, ECB, SPO and DLM sentences were received correctly by EUT using Query sentence. Confirm that EUT is receiving position reports on both A and B channels from 5 test targets and verify that the VDM has the correct data for the 5 test targets.Confirm the EUT is not broadcasting.

b) Confirm that the appropriate TFR sentence is output on the PI. Confirm that the EUT is broadcasting Message 4 in the assigned slot and channel. Confirm that the Message 4 contains the same data as defined by the VDM sentence. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted.

c) Confirm that EUT did not broadcast Message 14 and issued an ABK type 2

NOTE The following results are required for a Base Station operated as an independent unit.

d) Confirm that the DLM sentences were received correctly by EUT using Query sentence for DLM.

e) Confirm that the ECB sentences were received correctly by EUT using Query sentence for ECB Confirm that the EUT is broadcasting Message 4 and Message 20 in the assigned slots, interval, and channels as defined in the ECB sentences. Confirm that the content of Message 20s is as defined by the DLM. Confirm that the EUT is broadcasting message 4 with an interval of 10 s, alternating transmission channels A and B. Confirm that the content of Message 4 is as defined by the BCF. Confirm that in the content of Message 4 the UTC/date is provided correctly. Confirm that the communications state for Message 4 is implemented correctly. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted.

f) Confirm that the VSI sentence contains the associated information about each VDM or VDO sentence. Confirm that the FSR sentence contains the associated information about the conditions for the previous frame.

10.2.1.3 Retention of Base Station Report Information content and Reporting Rate

10.2.1.3.1 Purpose

This test will verify that a Base Station retains all of its configuration settings upon restart. There are two methods of restart, a physical restart of the Base Station and a restart using the CAB sentence. This test will verify that the Base Station retains its last

configuration after these restart. The test will also verify that the Base Station sets its configuration to “undefined” after reset.

10.2.1.3.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

a) Remove power from the EUT for 2 seconds and then re-apply power to the EUT.

b) Apply the following CAB sentence to the EUT.

$xxCAB,,,1,*hh<CR><LF>

c) Apply the following DLM sentence to the EUT.

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

d) Apply the following ECB sentences to the EUT.

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

e) Remove power from the EUT for 2 seconds and then re-apply power to the EUT.

f) Apply the following CAB sentence to the EUT.

$xxCAB,,,,*hh<CR><LF>1

g) Apply the following CAB sentence to the EUT.

$xxCAB,,,,1*hh<CR><LF>1

10.2.1.3.3 Required Results

a) Confirm that BCF, DLM and ECB sentences were retained correctly, as defined by the Pre-Setup conditions, by EUT using Query for these sentences. Confirm that EUT is receiving position reports on both A and B channels from 5 test targets. These results shall occur within 2 minutes.

b) Confirm that BCF sentence was retained correctly by EUT using Query sentence for BCF sentence. Confirm that EUT is receiving position reports on both A and B channels from 5 test targets. These results shall occur within 2 minutes.

c) Confirm that the DLM sentences were received correctly by EUT using Query sentence for DLM.

d) Confirm that the ECB sentences were received correctly by EUT using Query sentence for ECB.

e) Confirm that BCF and ECB sentences were retained correctly by EUT using Query for these sentences. Confirm that EUT is receiving position reports on both A and B channels from 5 test targets. Confirm that the EUT is broadcasting Message 4 and Message 20 in the assigned slots, interval, and channels as defined in the ECB sentences. Confirm that the content of Message 20s is as defined by the DLM. Confirm that the content of Message 4 is as defined by the BCF. Confirm that in the content of Message 4 the UTC/date is provided correctly. Confirm that the communications state for Message 4 is handled properly. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted.

These results shall occur within 2 minutes.

f) Confirm that BCF and ECB sentences were retained correctly by EUT using Query for these sentences. Confirm that EUT is receiving position reports on both A and B channels from 5 test targets. Confirm that the EUT is broadcasting Message 4 and Message 20 in the assigned slots, interval, and channels as defined in the ECB sentences. Confirm that the content of Message 20s is as defined by the DLM. Confirm that the content of Message 4 is as defined by the BCF. Confirm that in the content of Message 4 the UTC/date is provided correctly. Confirm that the

communications state for Message 4 is handled properly. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted.

These results shall occur within 2 minutes.

g) Verify all configuration information is undefined with the exception of receive only on AIS1 and AIS2

10.2.1.4 Configuration and Operating Parameters

10.2.1.4.1 Purpose

This test will verify that the Base Station configuration can be modified. In addition it will verify the non-default settings. The operation of the TSA+VDM transmission is verified when operating independently.

10.2.1.4.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions. Switch the working channels for the 5 test targets to appropriate channels as defined the new BCF sentence.

a) Apply the following SID, and the following BCF sentence to the EUT.

$xxSID,xxxxxxxxxxxxxxxxxxxx,AA003770008,003770008,*hh<CR><LF>

$xxBCF,003770007,1,,,,,0,2085,2086,2085,2086,1,1,0,0,AB*hh<CR><LF>

b) Apply the following BCF and BCE sentences to the EUT.

$xxBCF,003770008,1,,,,,0,2085,2086,2085,2086,1,1,0,0,AB*hh<CR><LF>

$xxBCE,AA003770008,1,,*hh<CR><LF>

c) Apply a TSA sentence and a VDM sentence with encapsulated Message 4 to the EUT.

$xxTSA,AA003770008,9,A,HHMMSS,1050,1,2*hh<CR><LF>

!xxVDM,1,1,9,A,40C4qnh00041?G1RMfL0tJi004P4,0*hh<CR><LF>

NOTE The following tests are required for a Base Station operated as an independent unit.

d) Apply the following DLM sentence to the EUT.

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

e) Apply the following ECB sentences to the EUT to start autonomous transmissions.

$xxECB,AA003770008,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770008,20,0,0,0,,0,6,0,,*hh<CR><LF>

f) Modify the DLM reservations

$xxDLM,0,A,L,104,1,7,250,L,100,1,7,0,,,,,,,,,,*hh<CR><LF>

$xxDLM,0,B,L,229,1,7,250,L,106,1,7,0,,,,,,,,,,*hh<CR><LF>

g) Apply the following ECB sentences to modify the transmission slots:

$xxECB,AA003770008,4,0,104,750,,0,479,750,*hh<CR><LF>

$xxECB,AA003770008,20,0,100,0,,0,106,0,,*hh<CR><LF>

h) Apply the following DLM sentence to the EUT:

$xxDLM,0,A,C,,,,,C,,,,,,,,,,,,,,*hh<CR><LF>

$xxDLM,0,B,C,,,,,C,,,,,,,,,,,,,,*hh<CR><LF>

i) Apply the following ECB sentence to the EUT:

$xxECB,AA003770008,20,0,-1,,,0,-1,,*hh<CR><LF>

j) Apply the following CAB sentence to the EUT.

$xxCAB,0,1,,*hh<CR><LF>

k) Apply a TSA sentence and a VDM sentence with encapsulated Message 4 to the EUT on the disabled channel.

$xxTSA,AA003770008,9,A,HHMMSS,1050,1,2*hh<CR><LF>

!xxVDM,1,1,9,A,40C4qnh00041?G1RMfL0tJi004P4,0*hh<CR><LF>

l) Apply the following ECB sentence to the EUT.

$xxECB,AA003770008,4,0,-1,,,0,-1,,*hh<CR><LF>

m) Apply the following BBM and VDM sentences to the EUT

$xxBBM,1,1,0,0,14,D5CDP=5CC175,0*hh<CR><LF>

!xxVDM,2,1,7,A,502=aEP000000000000ph9u0ThuC:222222222016@jl071C0vScnhH88,0*hh<CR><LF>

!xxVDM,2,2,7,A,888888888888888,2*hh CR><LF>

10.2.1.4.3 Required results

a) Confirm that BCF sentence was ignored by EUT using Query sentence for BCF sentence

b) Confirm that BCF and BCE sentences were processed correctly by EUT using Query sentences.

c) Confirm that the appropriate TFR sentence is output on the PI. Confirm that the EUT did broadcast the Message 4 in the assigned slot and channel. Confirm that the content of Message 4 is as defined by VDM Sentence. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted.

NOTE The following results are required for a Base Station operated as an independent unit.

d) Confirm that the DLM sentences were received correctly by EUT using Query sentence for DLM.

e) Confirm that the ECB sentences were received correctly by EUT using Query sentence for ECB. Confirm that the EUT is broadcasting Message 4 and Message 20 in the assigned slots, interval and channel as defined in the ECB sentence. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted. Confirm that the content of Message 4 is as defined by the BCF sentence. Confirm that the content of Message 20 is as defined by the DLM sentence. Confirm that EUT is receiving position reports on both channels A and B from the 5 AIS targets.

f) Confirm that the DLM sentences were received correctly using Query sentence for DLM.

g) Confirm that the ECB sentences were received correctly using Query sentence for ECB. Confirm that the EUT is broadcasting Message 4 and Message 20 in the assigned slots, interval and channel as defined in the ECB sentence. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted.

h) Confirm that the DLM sentences were received correctly using Query sentence for DLM

i) Confirm that the ECB sentences were received correctly using Query sentence for ECB. Confirm that the Base Station stops broadcasting Message 20. Confirm that the EUT is only broadcasting Message 4 in the assigned slots as defined in the ECB message.

j) Confirm that CAB sentence was received correctly by EUT using Query sentence for CAB sentence. Confirm that EUT is receiving position reports on both A and B channels from other AIS. Confirm that the EUT is broadcasting Message 4 in the assigned slots, interval and transmitting on channel B only at a reporting rate of 20 seconds.

k) Confirm that the appropriate TFR sentence with status 9 is output on the PI. Confirm that the EUT is NOT broadcasting Message 4 in channel A.

l) Confirm that the ECB sentences were received correctly by EUT using Query sentence for ECB. Confirm that the Base Station stops broadcasting Message 4.

m) Confirm that the EUT broadcast Message 14 and issued an ABK type 0. Confirm that the EUT broadcast Message 5.

10.2.1.5 FATDMA Configuration

10.2.1.5.1 Purpose

This test will verify the ability of the Base Station to configure all twenty FATDMA data set definitions (ten per channel).

10.2.1.5.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

NOTE The following tests are required for a Base Station operated as an independent unit.

a) Apply the following BCE sentece to enable the use of RATDMA:

$xxBCE,AA003770007,1,,*hh<CR><LF>

b) Apply the following 20 DLM sentences to the EUT.

$xxDLM,0,A,L,0004,1,7,0250,L,0000,1,7,0000,L,0010,1,7,0450,L,0070,2,7,0075*hh<CR><LF>

$xxDLM,0,B,L,0129,1,7,0250,L,0006,1,7,0000,L,0012,1,7,0450,L,0050,2,7,0075*hh<CR><LF>

$xxDLM,1,A,L,0100,1,7,0000,L,0101,2,6,0000,L,0103,3,5,0000,L,0106,5,4,0000*hh<CR><LF>

$xxDLM,1,B,L,0300,1,7,0000,L,0301,2,6,0000,L,0303,3,5,0000,L,0306,5,4,0000*hh<CR><LF>

$xxDLM,2,A,L,0400,1,7,0000,L,0401,2,6,0000,L,0403,3,5,0000,L,0406,5,4,0000*hh<CR><LF>

$xxDLM,2,B,L,0600,1,7,0000,L,0601,2,6,0000,L,0603,3,5,0000,L,0606,5,4,0000*hh<CR><LF>

$xxDLM,3,A,L,0700,1,7,0000,L,0701,2,6,0000,L,0703,3,5,0000,L,0706,5,4,0000*hh<CR><LF>

$xxDLM,3,B,L,0900,1,7,0000,L,0901,2,6,0000,L,0903,3,5,0000,L,0906,5,4,0000*hh<CR><LF>

$xxDLM,4,A,L,1100,1,7,0000,L,1101,2,6,0000,L,1103,3,5,0000,L,1106,5,4,0000*hh<CR><LF>

$xxDLM,4,B,L,1200,1,7,0000,L,1201,2,7,0000,L,1203,3,7,0000,L,1206,5,7,0000*hh<CR><LF>

$xxDLM,5,A,L,1300,1,7,0000,L,1301,2,6,0000,L,1303,3,5,0000,L,1306,5,4,0000*hh<CR><LF>

$xxDLM,5,B,L,1500,1,7,0000,L,1501,2,7,0000,L,1503,3,7,0000,L,1506,5,7,0000*hh<CR><LF>

$xxDLM,6,A,L,1600,1,7,0000,L,1601,2,7,0000,L,1603,3,7,0000,L,1606,5,7,0000*hh<CR><LF>

$xxDLM,6,B,L,1800,1,7,0000,L,1801,2,7,0000,L,1803,3,7,0000,L,1806,5,7,0000*hh<CR><LF>

$xxDLM,7,A,L,1900,1,7,0000,L,1901,2,7,0000,L,1903,3,7,0000,L,1906,3,7,0000*hh<CR><LF>

$xxDLM,7,B,L,2100,1,7,0000,L,2101,2,7,0000,L,2103,3,7,0000,L,2106,5,7,0000*hh<CR><LF>

$xxDLM,8,A,L,2150,1,7,0000,L,2151,2,7,0000,L,2153,3,7,0000,L,2156,5,7,0000*hh<CR><LF>

$xxDLM,8,B,L,2200,1,7,0000,L,2201,2,7,0000,L,2203,3,7,0000,L,2206,5,7,0000*hh<CR><LF>

$xxDLM,9,A,L,1700,1,7,0000,L,1701,2,7,0000,L,1703,3,7,0000,L,1706,5,7,0000*hh<CR><LF>

$xxDLM,9,B,L,1750,1,7,0000,L,1751,2,7,0000,L,1753,3,7,0000,L,1756,5,7,0000*hh<CR><LF>

c) Apply the following ECB Sentence to the EUT

$xxECB,AA003770007,20,0,10,450,,0,12,450,*hh<CR><LF>

d) Apply the following DLM sentences to remove the FATDMA allocations.

$xxDLM,0,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,0,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,1,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,1,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,2,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,2,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,3,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,3,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,4,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,4,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,5,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,5,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,6,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,6,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,7,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,7,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,8,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,8,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,9,A,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

$xxDLM,9,B,C,,,,,C,,,,,C,,,,,C,,,,*hh<CR><LF>

e) Apply the following DLM sentences to the EUT

$xxDLM,0,A,L,0004,1,7,0250,L,0010,1,7,0450,R,0005,5,7,0030,R,0015,5,7,0030*hh<CR><LF>

$xxDLM,1,A,R,0020,4,7,0030,R,0025,5,7,0030,R,0030,4,7,0030,R,0011,2,7,0030*hh<CR><LF>

f) Apply the following BBM sentences to the EUT

$xxBBM,1,1,0,0,14,D5CDPC165DIP=5CC1750,0*hh<CR><LF>

10.2.1.5.3 **Required results**

NOTE The following results are required for a Base Station operated as an independent unit.

a) Confirm that the BCE sentences were received correctly by EUT using Query Sentence for BCE sentence.

b) Confirm that DLM sentences were received correctly by EUT using Query sentence for DLM sentence.

c) Confirm that the ECB sentences were received correctly by EUT using Query sentence for the ECB sentence. Confirm that the appropriate VDO sentence is output on the PI when a Message 20 is transmitted. Confirm that the EUT is broadcasting Message 20(s) over the VDL in the specified slots and specified channels with the specified configuration parameters from the DLM and ECB sentence. Confirm that all the Message 20 required by the full set of DLM sentences are broadcast over the VDL within 2 frames in the assigned slots as defined in the ECB sentence.

d) Confirm the DLM sentences were received correctly by the EUT using Query sentence for the DLM sentence. Confirm that the EUT is no longer broadcasting any Message 20 over the VDL. Confirm that the EUT continues to broadcast Message 4 over the VDL.

e) Confirm that DLM sentences were received correctly by EUT using Query sentence for DLM sentence.

f) Confirm that the Message 14 is broadcast over the VDL within 4 seconds using RATMDA in avaliable slots and not using the remotely allocated slots.

10.2.1.6 Channel Management

10.2.1.6.1 Purpose

This test will verify that the Base Station will transmit an addressed Message 22.

10.2.1.6.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

NOTE The following tests are required for a Base Station operated as an independent unit.

a) Apply the following ACA sentence to the EUT.

$xxACA,0,3500.00,N,08000.00,W,3400.00,N,08100.00,W,5,2087,0,2088,0,0,0,,,
*hh<CR><LF>

b) Apply the following DLM and ECB sentences to establish autonomous transmission of Messages 4 and 20 by the EUT:

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,*hh<CR><LF>

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

c) Apply the following DLM sentence to reserve slots for Message 22 transmissions.

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,1,7,75,L,1,1,7,0*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,1,7,75,L,7,1,7,0*hh<CR><LF>

d) Apply the following ECB sentence to start Message 22 transmissions by the EUT.

$xxECB,AA003770007,22,0,1,0,,0,7,0,*hh<CR><LF>

e) Apply the following ACM sentence to the EUT.

$xxACM, (MMSI of mobile 1),(MMSI of mobile 2),2087,0,2088,0,0,0,2*hh<CR><LF>

f) Cycle power on the EUT.

10.2.1.6.3 **Required results**

NOTE The following results are required for a Base Station operated as an independent unit.

a) Confirm that the ACA sentence was received correctly by EUT using Query sentence for the ACA sentence.

b) Confirm that the DLM sentence was received correctly by the EUT using Query sentence for the DLM sentence. Confirm that the ECB sentence was received correctly by the EUT using Query sentence for the ECB sentence.

c) Confirm that the DLM sentence was received correctly by the EUT using Query sentence for the DLM sentence.

d) Confirm that the ECB sentence was received correctly by the EUT using Query sentence for the ECB sentence. Confirm that the EUT is broadcasting Message 22 over the VDL in the specified slots and specified channels. Confirm the content of the Message 22 is as defined by the ACA message. Confirm that the EUT continues to broadcast Messages 4 and 20 as defined. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted.

e) Confirm that the EUT broadcasts the ACM to the specified mobiles within the 4 seconds. Confirm the content of the Message 22 is as defined by the ACM message and that the MMSI has the correct number of bits in Message 22.

f) Confirm that the EUT´s channel management settings are retained and that the Messages 22 starts broadcasting again within 2 min.

10.2.1.7 VDM re-broadcast

10.2.1.7.1 Purpose

This test will verify that the Base Station can receive multiple types of VDM inputs and broadcast the encapsulated Message as required by the Message type.

NOTE It is required that the repeat indicator is set to >0 before re-broadcasting, because Class B “CS” have to exclude those messages from their synchronisation algorithm.

10.2.1.7.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

NOTE The following tests are required for a Base Station operated as an independent unit.

a) Apply a VDM sentence to the EUT.

b) Apply the following DLM+ECB Sentences to establish autonomous transmission of Messages 4 and 20 by the EUT:

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

$xxBCE,AA003770007,1,,*hh<CF><LF>

c) Apply VDM sentences with encapsulated Message 1 to 23 to the EUT.

d) Apply the following VDM sentence with inappropriate comm-state and repeat indicator to the EUT:

!BSVDM,1,1,,A,15M3NSwP00J6TN>?a0e3Ngv000Sq,0*hh<CR><LF>

10.2.1.7.3 **Required results**

NOTE The following results are required for a Base Station operated as an independent unit.

a) Confirm the EUT does NOT broadcast the VDM.

b) Confirm that the DLM sentence was received correctly by the EUT using Query sentence for the DLM sentence. Confirm that the ECB sentence was received correctly by the EUT using Query sentence for the ECB sentence.

c) Confirm that the EUT is broadcasting the Message 1 to 23 as required over the VDL within 4 seconds in an available FATDMA or RATDMA slots and that the information is complete and correct. Confirm that VDL Message 4, 11 and 20 VDM sentences are not re-transmitted. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted.

d) Confirm that the EUT transmits the message after correcting comm-state and incrementing the repeat indicator by 1.

10.2.1.8 TSA and associated VDM processing

10.2.1.8.1 Purpose

This test will verify that the Base Station can receive a TSA and the associated VDM for all message types and transmit the encapsulated message as required by the message type in the assigned slot.

10.2.1.8.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

a) Apply TSA+VDM sentence pair with encapsulated Message 1 to 23 to the EUT.

b) Apply the following TSA+VDM sentence pair with inappropriate comm-state and repeat indicator to the EUT:

$xxTSA,AA00377007,9,A,HHMM,2100,1,2*hh<CR><LF>

!xxVDM,1,1,9,A,15M3NSwP00J6TN>?a0e3Ngv000Sq,0*hh<CR><LF>

c) Apply five TSA and five VDM sentences with encapsulated Message 1 to the EUT assigning the transmission of the five Messages 1s in consecutive slots on the same channel.

$xxTSA,AA00377007,0,A,HHMM,1001,1,2*hh<CR><LF>

!BSVDM,1,1,0,A,15M3NSwP00J6TN0?a0iT<Ov>0D01,0

$xxTSA,AA00377007,1,A,HHMM,1002,1,2*hh<CR><LF>

!BSVDM,1,1,1,A,15M3NSwP00J6TN0?a0iT<Ov>0D01,0

$xxTSA,AA00377007,2,A,HHMM,1003,1,2*hh<CR><LF>

!BSVDM,1,1,2,A,15M3NSwP00J6TN0?a0iT<Ov>0D01,0

$xxTSA,AA00377007,3,A,HHMM,1004,1,2*hh<CR><LF>

!BSVDM,1,1,3,A,15M3NSwP00J6TN0?a0iT<Ov>0D01,0

$xxTSA,AA00377007,4,A,HHMM,1005,1,2*hh<CR><LF>

!BSVDM,1,1,4,A,15M3NSwP00J6TN0?a0iT<Ov>0D01,0

d) Apply the TSA+VDM sentence pair with an encapsulated Message ID that is undefined, with the correct message structure to the EUT.

$xxTSA,AA00377007,5,A,HHMM,1005,1,2*hh<CR><LF>

!BSVDM,1,1,5,A,W5M3NSwP00J6TN0?a0iT<Ov>0D01,0

e) Apply a TSA sentence and a VDM sentence with encapsulated Message 8, using five slots.

$xxTSA,AA00377007,6,B,HHMM,1005,1,2*hh<CR><LF>

!xxVDM,3,1,6,B,8h3OHqh0J00@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048,0*hh<CR><LF>

!xxVDM,3,2,6,B,<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048,0*<CR><LF>

!xxVDM,3,3,6,B,<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT0,0*hh<CR><LF>

Apply a TSA sentence and a VDM sentence with encapsulated Message 14 at least 266 msec (10 slot duration) before the scheduled Message 8 using one slot and using the same start slot number on the same channel.

$xxTSA,AA00377007,7,B,HHMM,1005,1,2*hh<CR><LF>

!xxVDM,1,1,7,B,>h3OHqi@E=@,2*hh<CR><LF>

f) Apply a TSA sentence and a VDM sentence with encapsulated Message 14 using one slot with a UTC time that is outside the allowed window to the EUT.

$xxTSA,AA00377007,8,B,HHMM,1005,1,2*hh<CR><LF>

!xxVDM,1,1,7,B,>h3OHqi@E=@,2*hh<CR><LF>

g) Apply a TSA sentence and a VDM sentence with encapsulated Message 14 using an invalid slot number to the EUT.

$xxTSA,AA00377007,9,B,HHMM,2250,1,2*hh<CR><LF>

!xxVDM,1,1,7,B,>h3OHqi@E=@,2*hh<CR><LF>

h) Apply a TSA sentence and a VDM sentence with encapsulated Message 14 using six slots to the EUT.

$xxTSA,AA00377007,6,B,HHMM,1005,1,2*hh<CR><LF>

!xxVDM,3,1,6,B,>h3OHqh048<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048,0*hh<CR><LF>

!xxVDM,3,2,6,B,<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048,0*hh<CR><LF>

!xxVDM,3,3,6,B,<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048<@DHLPT048,0*hh<CR><LF>

i) Apply the number of TSA+VDM pairs as declared by the manufacturer to exceed available memory.

j) Apply a TSP to prohibit the use of slots.

$xxTSP,AA00377007,99,A,HHMM,0,1000,5,,,,*hh<CR><LF>

Apply a TSA+VDM that uses the prohibited slots reserved by the TSP.

$xxTSA,AA00377007,7,B,HHMM,1001,1,2*hh<CR><LF>

!xxVDM,1,1,7,B,>h3OHqi@E=@,2*hh<CR><LF>

Apply a TSA+VDM Message 8 pair in the subsequent frame for the same slots.

$xxTSA,AA00377007,7,B,HHMM,1001,1,2*hh<CR><LF>

!xxVDM,1,1,7,B,8h3OHqh0J7ps?3qv,0*hh<CR><LF>

k) Apply a TSA+VDM in the same slot, different frame from j).

$xxTSA,AA00377007,7,B,HHMM,1001,1,2*hh<CR><LF>

!xxVDM,1,1,7,B,>h3OHqi@E=@,2*hh<CR><LF>

NOTE The following tests are required for a Base Station operated as an independent unit.

l) Apply an ECB to begin the autonomous transmission of Message 4.

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

Apply a TSA/Message 8 VDM pair with low priority in conflict with the autonomous Message 4 transmission defined in the ECB

$xxTSA,AA00377007,7,B,HHMM,1129,1,2*hh<CR><LF>

!xxVDM,1,1,7,B,8h3OHqh0J7ps?3qv,0*hh<CR><LF>

m) Apply a TSA/Message 8 VDM pair with high priority in conflict with the autonomous Message 4 transmission defined in the ECB.

$xxTSA,AA00377007,7,B,HHMM,1879,1,1*hh<CR><LF>

!xxVDM,1,1,7,B,8h3OHqh0J7ps?3qv,0*hh<CR><LF>

n) Apply a TSP to reserve slots in conflict with the Message 4 schedule

$xxTSP,AA00377007,1,A,HHMM,0,750,5,,,,*hh<CR><LF>

10.2.1.8.3 Required results

a) Confirm that the appropriate TFR sentences are output on the PI. Confirm that the EUT is broadcasting the Messages 1 to 23 as required over the VDL in the assigned slots and that the information is complete and correct. Confirm that the appropriate VDO sentences are output on the PI when a message is transmitted.

b) Confirm that the appropriate TFR sentence is output on the PI. Confirm that the EUT transmits the message with no data content processing. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted.

c) Confirm that the appropriate TFR sentences are output on the PI. Confirm that the EUT transmits the five Message 1s in the assigned consecutive slots on the same channel and that the information is complete and correct. Confirm that the appropriate VDO sentences are output on the PI when a message is transmitted.

d) Confirm that the appropriate TFR sentence is output on the PI. Confirm that the EUT transmits the message with no data content processing. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted.

e) Confirm that the EUT generates a TFR sentence with status 0 for the Message 8 on the PI. Confirm that the EUT generates a TFR sentence with status 1 for the Message 14 on the PI. Confirm that the EUT transmits only the Message 14. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted.

f) Confirm that the EUT generates a TFR sentence with status 2 for the Message 14 on the PI. Confirm that the EUT does not transmit Message 14.

g) Confirm that the EUT generates a TFR sentence with status 10 for the Message 14 on the PI. Confirm that the EUT does not transmit Message 14.

h) Confirm that the EUT generates a TFR sentence with status 10 for the Message 14 on the PI. Confirm that the EUT does not transmit Message 14.

i) Confirm that the EUT generates a TFR sentence with status 3.

j) Confirm that the EUT generates a TSR sentence with status 0. Confirm that the EUT generates a TFR sentence with status 7. Confirm that the EUT generates a TFR sentence with status 0. Confirm the EUT transmits Message 8.

k) Confirm that the EUT generates a TFR sentence with status 0. Confirm the EUT transmits Message 14.

NOTE The following results are required for a Base Station operated as an independent unit.

l) Confirm that the CBM PI sentence was received correctly by the EUT using PI query for the CBM PI sentence. Confirm that the EUT generates a TFR sentence with status 5. Confirm the EUT does NOT transmit Message 8.

m) Confirm that the EUT generates a TFR sentence with status 1. Confirm the EUT transmits Message 8.

n) Confirm that the EUT generates a TSR sentence with status 1.

10.2.1.9 DGNSS VDM Message 17

10.2.1.9.1 Purpose

This test will verify that the Base Station is capable of handling a VDM with an encapsulated Message 17.

10.2.1.9.2 Method of measurement

NOTE The following tests are required for a Base Station operated as an independent unit.

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

a) Apply the following DLM sentence to the EUT.

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,1,7,75,L,10,2,7,0*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,1,7,75,L,85,2,7,0*hh<CR><LF>

b) Apply the following ECB sentence to the EUT.

$xxECB,AA00377007,17,0,10,750,2,0,85,750,2*hh<CR><LF>

c) Apply VDM sentences with encapsulated Message 17 for a period of 1 minute.

d) Discontinue the VDM sentences with encapsulated Message 17.

e) Apply the following ECB sentence to the EUT to disable the scheduling for Message 17.

$xxECB,AA00377007,17,0,-1,,,0,-1,,*hh<CR><LF>

f) Apply VDM sentences with encapsulated Message 17 for a period of 1 minute.

10.2.1.9.3 Required results

NOTE The following results are required for a Base Station operated as an independent unit.

a) Confirm that the DLM sentence was received correctly by the EUT using Query sentence for the DLM sentence.

b) Confirm that the ECB sentence was received correctly by the EUT using Query sentence for the ECB sentence.

c) Confirm that the EUT is broadcasting Message 17 over the VDL in the specified slots, intervals and channels as defined by the ECB. Confirm the content of the Message 17 is the most current and as defined by the VDM. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted.

d) Verify that the EUT stops broadcasting Message 17 over the VDL within 1 minute.

e) Confirm that the ECB sentence was received correctly by the EUT using Query sentence for the ECB sentence.

f) Verify that the EUT does not broadcast Message 17 over the VDL.

10.2.1.10 Assigned mode

10.2.1.10.1 Purpose

This test will verify that the Base Station can establish hard and soft slot assignments using a Message 16.

10.2.1.10.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

NOTE The following tests are required for a Base Station operated as an independent unit.

a) Apply the following DLM and ECB Sentences to establish autonomous transmission of Messages 4 and 20 by the EUT:

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

b) Input the following ASN sentence to the EUT

$xxDLM,0,A,L,4,1,7,750,L,0,1,7,0,L,10,1,7,150,,,,,*hh<CR><LF>

§xxASN,6042,,10,5,125557007,600,,0,1*hh<CR><LF>

c) Input the following BBM sentence (Message 8) to the EUT

$xxBBM,1,1,0,1,8,7E3B3C3E7E,0*hh<CR><LF>

10.2.1.10.3 **Required results**

NOTE The following results are required for a Base Station operated as an independent unit.

a) Confirm that the DLM sentence was received correctly by the EUT using Query sentence for the DLM sentence. Confirm that the ECB sentence was received correctly by the EUT using Query sentence for the ECB sentence.

b) Confirm that the EUT is broadcasting Message 16, within 4 seconds in an available FATDMA slot, over the appropriate channel on the VDL. Confirm the content of the Message 16 is as defined by the ASN. Confirm that the slot used for the transmission and the slot offset information agree with the “hard assignment” parameters supplied with the ASN sentence. Confirm that the reporting interval information for the transmission agrees with the “soft assignment” parameters supplied with the ASN sentence. Confirm that the appropriate VDO sentence is output on the PI when a Message is transmitted.

c) Confirm that the EUT is broadcasting Message 8 within 4 seconds not using an assigned FATDMA slot.

10.2.1.11 Receive Messages

10.2.1.11.1 Purpose

This test will verify that the Base Station is capable of receiving all VDL Message types and outputting a VDM to the PI. The contents of binary Message 8 will verify the bit stuffing capability and the correct CRC check of the received messages is also verified.

10.2.1.11.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

a) Input the following messages to the VDL:

Message 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24

b) Apply a simulated position report Message with wrong CRC bit sequence to the VDL.

10.2.1.11.3 Required results

a) Check that the EUT outputs each Message to the Presentation Interface with the Message content complete and correct.

b) Verify that the Message is not output on the PI.

10.2.2 Addressed and Broadcast Messaging

10.2.2.1 Normal Operations

10.2.2.1.1 Purpose

This test will verify that the Base Station is capable of transmitting both broadcast (Messages 8, 14) and addressed (Messages 6, 12) safety related and binary messages.

10.2.2.1.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

NOTE The following tests are required for a Base Station operated as an independent unit.

a) Input the following BBM sentence to the EUT,

$xxBBM,1,1,0,1,8,7E3B3C3E7E,0

b) Input the following ABM sentence to the EUT

$xxABM,1,1,2,000001005,1,6,06P0test,0

c) Apply the following DLM and ECB sentences to establish autonomous transmission of messages 4 and 20 by the EUT:

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

d) Input the following BBM sentences to the EUT,

$xxBBM,1,1,0,1,8,7E3B3C3E7E,0*hh<CR><LF>

$xxBBM,1,1,0,0,14,D5CDP=5CC175,0*hh<CR><LF>

e) Input the following ABM sentence to the EUT

$xxABM,1,1,2,000001005,1,6,06P0test,0*hh<CR><LF>

$xxABM,1,1,0,6042,0,12,D5CDP=5CC175,0*hh<CR><LF>

The addressed station shall provide the appropriate response, Messages 7 and13.

f) Input the following BBM sentence to the EUT.

$xxBBM,4,1,6,2,8,06P045678901234567890123456789012345678 90123456789,0*hh<CR><LF>

$xxBBM,4,2,6,2,8,012345678901234567890123456789012345678 90123456789,0*hh<CR><LF>

$xxBBM,4,3,6,2,8,012345678901234567890123456789012345678 90123456789,0*hh<CR><LF>

$xxBBM,4,4,6,2,8,012345678901234567890123456789012345678 9012345678901,4*hh<CR><LF>

$xxBBM,4,1,7,2,14,012345678901234567890123456789012345678 90123456789,0*hh<CR><LF>

$xxBBM,4,2,7,2,14,012345678901234567890123456789012345678 90123456789,0*hh<CR><LF>

$xxBBM,4,3,7,2,14,012345678901234567890123456789012345678 90123456789,0*hh<CR><LF>

$xxBBM,4,4,7,2,14,012345678901234567890123456789012345678 90123456789,0*hh<CR><LF>

g) Input the following ABM sentences to the EUT.

$xxABM,4,1,5,432674839,2,6,01234567890123456789012345678901234567890123456789,0*hh<CR><LF>

$xxABM,4,2,5,432674839,2,6,01234567890123456789012345678901234567890123456789,0*hh<CR><LF>

$xxABM,4,3,5,432674839,2,6,01234567890123456789012345678901234567890123456789,0*hh<CR><LF>

$xxABM,4,4,5,432674839,2,6,01234567890123456789012345678901234567890123456789,0*hh<CR><LF>

$xxABM,4,1,6,432674839,2,12,01234567890123456789012345678901234567890123456789,0*hh<CR><LF>

$xxABM,4,2,6,432674839,2,12,01234567890123456789012345678901234567890123456789,0*hh<CR><LF>

$xxABM,4,3,6,432674839,2,12,01234567890123456789012345678901234567890123456789,0*hh<CR><LF>

$xxABM,4,4,6,432674839,2,12,01234567890123456789012345678901234567890123456789,0*hh<CR><LF>

h) Input the following BBM sentence to the EUT.

$xxBBM,5,1,1,2,14,wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww,0*hh<CR><LF>

$xxBBM,5,2,1,2,14,wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww,0*hh<CR><LF>

$xxBBM,5,3,1,2,14,wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww,0*hh<CR><LF>

$xxBBM,5,4,1,2,14,wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww,0*hh<CR><LF>

$xxBBM,5,5,1,2,14,ww,0*hh<CR><LF>

i) Establish 80 % channel load. Initiate the transmission of two 5 slot messages (Message 12 and Message 8) by the EUT. (5*5 slot blocks within 4 seconds to creatre a 4 sets of candidate slots within 4 seconds)

10.2.2.1.3 **Required results**

NOTE The following results are required for a Base Station operated as an independent unit.

a) Confirm that the EUT does NOT transmit and generates an ABK type 2.

b) Confirm that the EUT does NOT transmit and generates an ABK type 2.

c) Confirm that the DLM sentence was received correctly by the EUT using PI Query for DLM. Confirm that the ECB sentence was received correctly by the EUT using PI Query for ECB.

d) Confirm that the EUT is broadcasting Messages 8 and 14 once each over the VDL with the specified configuration parameters from the associated BBM sentences within 4 seconds using available FATDMA slots. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted. Confirm that the ABK sentence with ABK type 3 is output on the PI of the EUT when Messages 8 and 14 are transmitted.

e) Confirm that the EUT is broadcasting Messages 6 and 12 once each over the VDL with the specified configuration parameters from the associated ABM sentences within 4 seconds using available FATDMA slots. Confirm that the appropriate VDO sentence is output on the PI when a Message is transmitted. Confirm that the EUT has received the Binary Acknowledgement Message 7 and Safety Related Acknowledgement Message 13 from the addressed station by reviewing the PI VDM sentences. Confirm that the ABK sentence with ABK type 0 is output on the PI of the EUT when acknowledge to Messages 6 and 12 are received.

f) Confirm that the EUT is broadcasting Messages 8 and 14 once each over the VDL with the specified configuration parameters from the associated BBM sentences within 4 seconds using available FATDMA slots. Confirm that the appropriate VDO sentence is output on the PI when a Message is transmitted. Confirm that the ABK Sentence with ABK type 3 is output on the PI of the EUT when Messages 8 and 14 are transmitted.

g) Confirm that the EUT is broadcasting Messages 6 and 12 once each over the VDL with the specified configuration parameters from the associated ABM sentences within 4 seconds using available FATDMA slots. Confirm that the appropriate VDO sentence is output on the PI when a Message is transmitted. Confirm that the EUT has received the Binary Acknowledgement Message 7 and Safety Related Acknowledgement Message 13 from the addressed station by reviewing the PI VDM sentences. Confirm that the ABK sentence with ABK type 0 is output on the PI of the EUT when acknowledge to Messages 6 and 12 are received.

h) Confirm that the EUT did not broadcast the Message 14. Confirm that the EUT response with an ABK sentence with ABK type ‘2’.

i) Check that EUT transmits in correct order according to their priority (ITU-R M.1371-1 A/3.3.8.1 table 13) (Messages 12 before 8). Check that the EUT transmits in free slots within 4 seconds according the RATDMA algorithm.

10.2.2.2 Unacknowledged Messaging

10.2.2.2.1 Purpose

This test will verify that the Base Station will retry the transmission of an addressed Message as defined by the retry field in the BCF sentence.

10.2.2.2.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

NOTE The following tests are required for a Base Station operated as an independent unit.

a) Apply the following DLM and ECB sentences to establish autonomous transmission of Messages 4 and 20 by the EUT:

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

b) Input the following ABM sentence to the EUT to an MMSI other than the 5 test targets in the standard test environment

$xxABM,1,1,0,6042,0,12,D5CDP=5CC175,0*hh<CR><LF>

c) Input the following BCF sentence to the EUT.

$xxBCF,003660007,0,2959.9990,N,8359.9990,W,1,2087,2088,2087,2088,0,0,1,3, BS*hh<CR><LF>

Input the following ABM sentence to the EUT to an MMSI other than the 5 test targets in the standard test environment

$xxABM,1,1,0,6042,0,12,D5CDP=5CC175,0*hh<CR><LF>

10.2.2.2.3 Required results

NOTE The following results are required for a Base Station operated as an independent unit.

a) Confirm that the DLM sentence was received correctly by the EUT using PI Query for DLM. Confirm that the ECB sentence was received correctly by the EUT using PI Query for ECB.

b) Confirm that the EUT is transmitting Message 12 over the VDL with the specified configuration parameters from the associated ABM Sentence within 4 seconds using the available FATDMA slot. Confirm that the EUT re-transmits the Message 12, within 4 to 8 seconds after the previous transmission using the available FATDMA slot, in accordance with the EUT “Number of Retries” configuration from the BCF sentence. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted. Confirm that the ABK sentence with ABK type is 1 is output on the PI of the EUT after the last transmission of Message 12.

c) Confirm that the DLM sentence was received correctly by the EUT using PI Query for DLM. Confirm that the EUT is transmitting Message 12 over the VDL with the specified configuration parameters from the associated ABM sentence within 4 seconds using the available FATDMA slot. Confirm that the EUT re-transmits the Message 12, within 4 to 8 sec using the available FATDMA slot, in accordance with the EUT “Number of Retries” configuration from the BCF sentence. Confirm that the appropriate VDO sentence is output on the PI when a message is transmitted. Confirm that the ABK type 1 is output on the PI of the EUT after the last transmission of Message 12.

10.2.3 Interrogations and Interrogation response

10.2.3.1 Interrogation transmission

10.2.3.1.1 Purpose

This test will verify that the Base Station can transmit an interrogation, Message 15.

10.2.3.1.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

NOTE The following tests are required for a Base Station operated as an independent unit.

a) Apply the following DLM and ECB sentences to establish autonomous transmission of Messages 4 and 20 by the EUT:

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

b) Input an AIR sentence to the EUT; Interrogate for Messages 3, 4, 5, 9, 17, 18, 19, 20, 21, 22, 24

10.2.3.1.3 Required results

NOTE The following results are required for a Base Station operated as an independent unit.

a) Confirm that the DLM sentence was received correctly by the EUT using PI Query for DLM. Confirm that the ECB sentence was received correctly by the EUT using PI Query for ECB.

b) Confirm that the EUT is broadcasting Message 15 over the VDL with the specified configuration parameters from the associated AIR sentence within 4 seconds using an available FATDMA slot. Confirm that the appropriate VDO sentence is output on the PI when a Message is transmitted. Confirm that the EUT outputs an ABK with ABK type is 3 to the PI after the Message 15 has been transmitted.

10.2.3.2 Interrogation response

10.2.3.2.1 Purpose

This test will verify the ability of the Base Station to respond to an interrogation request.

10.2.3.2.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

a) Apply a Message 15 onto the VDL, addressing the EUT requesting Messages 4, 17, 20, 22.

NOTE The following tests are required for a Base Station operated as an independent unit.

b) Apply the following DLM and ECB sentences to establish autonomous transmission of Messages 4 and 20 by the EUT:

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

c) Apply a Message 15 onto the VDL, addressing the EUT requesting Messages 4, 17, 20, 22.

Apply a Message 15 onto the VDL, addressing the EUT requesting Message 1.

d) Apply the following ECB sentence to the EUT.

$xxECB,AA003770007,4,0,-1,,0,-1,*hh<CR><LF>

Apply a Message 15 onto the VDL, addressing the EUT requesting Messages 4 and 20.

10.2.3.2.3 Required results

a) Confirm the EUT does NOT respond

NOTE The following results are required for a Base Station operated as an independent unit.

b) Confirm that the DLM sentence was received correctly by the EUT using Query sentence for the DLM sentence. Confirm that the ECB sentence was received correctly by the EUT using Query sentence for the ECB sentence.

c) Check that the EUT transmits the appropriate Message 4, and 20 as determined by the ECB sentence. Confirm that the appropriate VDO sentence is output on the PI when a Message is transmitted. Check that the EUT does not transmit Message 17 and 22. Check that the EUT does not transmit Message 1.

d) Check that the EUT transmits the appropriate Message 4 within 4 seconds. Confirm that the appropriate VDO sentence is output on the PI when a Message is transmitted. Check that the EUT does not transmit Message 20.

10.2.4 Addressed operation

10.2.4.1 Receive addressed message

10.2.4.1.1 Purpose

This test will verify that the Base Station will respond to addressed messages with the appropriate Message type. This test will also verify that the Base Station does not respond to messages that are not addressed to the EUT.

10.2.4.1.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

a) Apply a Message 6 onto the VDL, addressed to the EUT

b) Apply a Message 12 onto the VDL, not addressed to the EUT.

c) Apply a Message 10 onto the VDL, addressed to the EUT.

NOTE The following tests are required for a Base Station operated as an independent unit.

d) Apply the following DLM and ECB sentences to establish autonomous transmission of Messages 4 and 20 by the EUT:

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

$xxBCE,AA003770007,1,,*hh<CR><LF>

e) Apply a Message 6 onto the VDL, addressing the EUT

f) Apply a Message 12 onto the VDL, not addressing the EUT.

g) Apply a Message 10 onto the VDL, addressing the EUT

10.2.4.1.3 Required results

a) Confirm the EUT does NOT transmit.

b) Confirm the EUT does NOT transmit.

c) Confirm the EUT does NOT transmit.

NOTE The following results are required for a Base Station operated as an independent unit.

d) Confirm that the DLM sentence was received correctly by the EUT using PI Query for DLM. Confirm that the ECB sentence was received correctly by the EUT using PI Query for ECB.

e) Check that EUT transmits Message 7 as a response. Check for the VDM and VDO sentences output using the PI.

f) Check that EUT does not transmit Message 13 as a response. Check for the VDM sentence output using the PI.

g) Check that the EUT transmits a Message 4 as a response. Check for the VDM and VDO sentence output using the PI.

10.2.5 Slot Phase and Frame Synchronization – Base Station Operation

10.2.5.1 UTC Direct

10.2.5.1.1 Purpose

This test will verify that the Base Station will operate as required with UTC direct synchronisation mode. This test will also verify synchronisation jitter.

10.2.5.1.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

a) Disable the UTC source for the Base Station. Insert multiple Message 1(s) on the VDL with comm. State 0, indicating UTC direct.

Apply a TSA sentence and a VDM sentence with encapsulated Message 8 to EUT.

$xxTSA,AA00377007,7,B,HHMM,1001,1,2*hh<CR><LF>

!xxVDM,1,1,7,B,8h3OHqh0J7ps?3qv,0*hh<CR><LF>

b) Restore the UTC source to the Base Station.

Apply a TSA sentence and a VDM sentence with encapsulated Message 8 to EUT.

$xxTSA,AA00377007,7,B,HHMM,1001,1,2*hh<CR><LF>

!xxVDM,1,1,7,B,8h3OHqh0J7ps?3qv,0*hh<CR><LF>

NOTE The following tests are required for a Base Station operated as an independent unit.

c) Apply the following DLM and ECB sentences to establish autonomous transmission of Messages 4 and 20 by the EUT:

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

$xxBCE,AA003770007,1,,*hh<CF><LF>

d) Disable the UTC source for the Base Station. Insert multiple Message 1(s) on the VDL with comm. State 0, indicating UTC direct.

e) Restore the UTC source to the Base Station.

10.2.5.1.3 Required Results

a) Confirm that the EUT is broadcasting Message 8 in the assigned slot and channel Verify synchronisation jitters does not exceed ± 156 us as required doing UTC indirect. Confirm that the EUT outputs notification number 007 via PI. Confirm that the ADS indicates the current comm. State.

b) Confirm that the EUT is broadcasting Message 8 in the assigned slot and channel. Verify synchronisation jitters does not exceed ± 52 us as required doing UTC direct. Confirm that the EUT outputs notification number 042 via PI. Confirm that the ADS indicates the current comm. State.

NOTE The following results are required for a Base Station operated as an independent unit.

c) Confirm that the DLM sentence was received correctly by the EUT using Query sentence for the DLM sentence. Confirm that the ECB sentence was received correctly by the EUT using Query sentence for the ECB sentence.

d) Verify that the Base Station maintains the same reporting rate for Message 4 but changes the comm. State to 1. Verify synchronisation jitters does not exceed ± 156 us as required doing UTC indirect. Confirm that the slot length is 26,67 ms. Confirm that the EUT outputs notification number 007 using PI. Confirm that the ADS indicates the current comm. State.

e) Verify that the comm. State of the Message 4(s) is 0, indicating UTC direct. Confirm that the EUT outputs notification number 042 using PI. Confirm that the ADS indicates the current comm. State.

10.2.5.2 UTC Indirect to a Base Station:

10.2.5.2.1 Purpose

This test will verify that the Base Station will operate as required with UTC indirect synchronisation mode. This test will also verify synchronisation jitter.

10.2.5.2.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

a) Disable the UTC source for the Base Station.

Insert Message 1(s) on the VDL with comm. State 0, indicating UTC direct.

Insert Message 4(s) on the VDL with comm. State 0, indicating UTC direct with a position distance of 120NM at the slot following the EUT message 4 transmission.

Apply a TSA sentence and a VDM sentence with encapsulated Message 8 to EUT.

$xxTSA,AA00377007,7,B,HHMM,1001,1,2*hh<CR><LF>

!xxVDM,1,1,7,B,8h3OHqh0J7ps?3qv,0*hh<CR><LF>

b) Restore the UTC source to the Base Station.

Apply a TSA sentence and a VDM sentence with encapsulated message Message 8 to EUT.

$xxTSA,AA00377007,7,B,HHMM,1001,1,2*hh<CR><LF>

!xxVDM,1,1,7,B,8h3OHqh0J7ps?3qv,0*hh<CR><LF>

NOTE The following tests are required for a Base Station operated as an independent unit.

c) Apply the following DLM and ECB sentences to establish autonomous transmission of Messages 4 and 20 by the EUT:

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

$xxBCE,AA003770007,1,,*hh<CR><LF>

d) Disable the UTC source for the Base Station.

Insert Message 1(s) on the VDL with comm. State 0, indicating UTC direct.

Insert Message 4(s) on the VDL with comm. State 0, indicating UTC direct. with a position distance of 120NM at the slot following the EUT message 4 transmission.

e) Restore the UTC source to the Base Station.

10.2.5.2.3 Required Results

a) Confirm that the EUT is broadcasting Message 8 in the assigned slot and channel. Verify synchronisation jitters does not exceed ± 156 µs as required doing UTC indirect taking into account propagation delay. Confirm that the EUT outputs notification number 007 via PI. Confirm that the ADS indicates the current comm. State.

b) Confirm that the EUT is broadcasting Message 8 in the assigned slot and channel. Verify synchronisation jitters does not exceed ± 52 µs as required doing UTC direct. Confirm that the EUT outputs notification number 042 via PI. Confirm that the ADS indicates the current comm. State.

NOTE The following results are required for a Base Station operated as an independent unit.

c) Confirm that the DLM sentence was received correctly by the EUT using Query sentence for the DLM sentence. Confirm that the ECB sentence was received correctly by the EUT using Query sentence for the ECB sentence.

d) Verify that the Base Station maintains the same reporting rate for Message 4 but changes the Sync State to 1 using the Base Station as UTC indirect sync source. Verify synchronisation jitters does not exceed ± 156 us as required doing UTC indirect. Confirm that the EUT outputs notification number 007 using PI. Confirm that the ADS indicates the current comm. State.

e) Verify that the comm. State of the Message 4(s) is 0, indicating UTC direct. Confirm that the EUT outputs notification number 042 using PI. Confirm that the ADS indicates the current comm. State.

10.2.5.3 Synchronised to Base Station:

10.2.5.3.1 Purpose

This test will verify that the Base Station will operate as required with indirect synchronisation to Base Station. This test will also verify synchronisation jitter.

10.2.5.3.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

a) Disable the UTC source for the Base Station. Insert Message 4(s), with a lower MMSI than the EUT, with comm. State 3, indicating semaphore operation.

   Apply a TSA sentence and a VDM sentence with encapsulated Message 8 to EUT.

   $xxTSA,AA00377007,7,B,HHMM,1001,1,2*hh<CR><LF>

   !xxVDM,1,1,7,B,8h3OHqh0J7ps?3qv,0*hh<CR><LF>

b) Restore the UTC source to the Base Station.

   Apply a TSA sentence and a VDM sentence with encapsulated Message 8 to EUT.

   $xxTSA,AA00377007,7,B,HHMM,1001,1,2*hh<CR><LF>

   !xxVDM,1,1,7,B,8h3OHqh0J7ps?3qv,0*hh<CR><LF>

NOTE The following tests are required for a Base Station operated as an independent unit.

c) Apply the following DLM and ECB sentences to establish autonomous transmission of Messages 4 and 20 by the EUT:

   $xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

   $xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

   $xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

   $xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

   $xxBCE,AA003770007,1,,*hh<CR><LF>

d) Disable the UTC source for the Base Station. Insert Message 4(s), with a lower MMSI than the EUT, with comm. State 3, indicating semaphore operation.

e) Restore the UTC source to the Base Station.

10.2.5.3.3 Required Results

a) Confirm that the EUT is broadcasting Message 8 in the assigned slot and channel. Confirm that the EUT does not broadcast Message 4. Verify synchronisation jitters does not exceed ± 104 us compared to the recived Message 4(s). Confirm that the EUT outputs notification number 007 via PI. Confirm that the ADS indicates the current comm. State.

b) Confirm that the EUT is broadcasting Message 8 in the assigned slot and channel. Verify synchronisation jitters does not exceed ± 52 us as required doing UTC direct. Confirm that the EUT outputs notification number 042 via PI. Confirm that the ADS indicates the current comm. State.

NOTE The following results are required for a Base Station operated as an independent unit.

c) Confirm that the DLM sentence was received correctly by the EUT using Query sentence for the DLM sentence. Confirm that the ECB sentence was received correctly by the EUT using Query sentence for the ECB Sentence.

d) Verify that the Base Station maintains the same reporting rate for Message 4 but changes the comm. State to 2. Verify synchronisation jitters does not exceed ± 104 us as required doing UTC indirect. Confirm that the EUT outputs notification number 007 using PI. Confirm that the ADS indicates the current comm. State.

e) Verify that the comm. State of the Message 4(s) is 0, indicating UTC direct. Confirm that the EUT outputs notification number 042 using PI. Confirm that the ADS indicates the current comm. State.

10.2.5.4 As a Semaphore:

10.2.5.4.1 Purpose

This test will verify that the Base Station will operate as semaphore. This test will also verify synchronisation jitter.

10.2.5.4.2 Method of measurement

NOTE The following tests are required for a Base Station operated as an independent unit.

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

a) Disable the UTC source for the Base Station. Insert Message 1(s) with comm. State 3, indicating semaphore operation, onto the VDL.

b) Restore the UTC source to the Base Station and insert Message 1(s) with comm. State 1 indicating UTC indirect.

c) Disable the UTC source for the Base Station. Insert Message 1(s) with comm. State 2, indicating Base Station synchronisation, onto the VDL.

d) Restore the UTC source to the Base Station and insert Message 1(s) with comm. State 1 indicating UTC indirect.

10.2.5.4.3 Required results

NOTE The following results are required for a Base Station operated as an independent unit.

a) Verify that the Base Station increases its Message 4, reporting rate to 3 1/3 s. Verify that the comm. State of the Message 4(s) is 3, indicating semaphore operation. Confirm that the EUT outputs notification number 007 using PI. Confirm that the ADS indicates the current comm. State.

b) Verify that the comm. State of the Message 4(s) is 0, indicating UTC direct. Verify that three minutes after the restoration of the UTC source, the Base Station decreases its reporting rate to 10 s. Confirm that the EUT outputs notification number 042 using PI. Confirm that the ADS indicates the current comm. State.

c) Verify that the Base Station increases its Message 4, reporting rate to 3 1/3 s. Verify that the comm. State of the Message 4(s) is 3, indicating semaphore operation. Confirm that the EUT outputs notification number 007 using PI. Confirm that the ADS indicates the current comm. State.

d) Verify that the comm. State of the Message 4(s) is 0, indicating UTC direct. Verify that three minutes after the restoration of the UTC source, the Base Station decreases its reporting rate to 10 s. Confirm that the EUT outputs notification number 042 using PI. Confirm that the ADS indicates the current comm. State.

10.2.6 Position Source

10.2.6.1 Purpose

This test will verify that the Base Station will accept and correctly handle each position source setting. In addition, this test will verify that the Base Station responds correctly if a position source is lost.

10.2.6.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

NOTE The following tests are required for a Base Station operated as an independent unit.

a) Apply the following DLM and ECB sentences to establish autonomous transmission of Messages 4 and 20 by the EUT:

$xxDLM,0,A,L,4,1,7,250,L,0,1,7,0,L,10,2,7,75,,,,,*hh<CR><LF>

$xxDLM,0,B,L,129,1,7,250,L,6,1,7,0,L,20,2,7,75,,,,,*hh<CR><LF>

$xxECB,AA003770007,4,0,4,750,,0,379,750,*hh<CR><LF>

$xxECB,AA003770007,20,0,0,0,,0,6,0,,*hh<CR><LF>

b) Input the following BCF sentence to the EUT indicating surveyed position.

$xxBCF,003770007,0,2959.9990,N,8359.9990,W,1,2087,2088,2087,2088,0,0,3,3, AB*hh<CR><LF>

c) If implemented, input the following BCF sentence to the EUT indicating internal position source

$xxBCF,003770008,1,,,,,0,2085,2086,2085,2086,1,1,0,0,AB*hh<CR><LF>

d) Remove the GPS antenna to generate a failure for the position.

e) If implemented, input the following BCF sentence to the EUT indicating external position source. Supply the EUT, using the PI, a series of GGA, RMC, or GLL sentences.

$xxBCF,003770008,2,,,,,0,2085,2086,2085,2086,1,1,0,0,AB*hh<CR><LF>

f) Discontinue the position sentences for 30 s.

g) Input the following BCF sentence to the EUT indicating survey position.

$xxBCF,003770007,0,2959.9990,N,8359.9990,W,1,2087,2088,2087,2088,0,0,3,3, AB*hh<CR><LF>

10.2.6.3 **Required results**

NOTE The following results are required for a Base Station operated as an independent unit.

a) Confirm that the DLM sentence was received correctly by the EUT using PI Query for DLM. Confirm that the ECB sentence was received correctly by the EUT using PI Query for ECB. Confirm that the BCF sentence was received correctly by the EUT using PI Query for BCF.

b) Confirm that the BCF sentence was received correctly by the EUT using PI Query for BCF. Confirm that the EUT transmits the Message 4 with a position source indicating surveyed. Confirm that the EUT outputs notification number 041 using PI Confirm that the ADS indicates the current position source.

c) Confirm that the BCF sentence was received correctly by the EUT using PI Query for BCF. Confirm that the EUT transmits the Message 4 with a position source indicating Internal. Confirm that the EUT outputs notification number 025 using PI. Confirm that the ADS indicates the current position source.

d) Confirm that Alarm Message 26 is output using the PI indicating a loss of position source. Confirm that the EUT transmits the Message 4 with no position available. Confirm that the ADS indicates the current position source.

e) Confirm that the BCF Sentence was received correctly by the EUT using PI Query for BCF. Confirm that the EUT transmits the Message 4 with a position source indicating external. Confirm that the EUT outputs notification number 022 using PI. Confirm that the ADS indicates the current position source.

f) Confirm that Alarm Message 26 is output using the PI indicating a loss of position source. Confirm that the EUT transmits the Message 4 with no position available. Confirm that the ADS indicates the current position source.

g) Confirm that the BCF Sentence was received correctly by the EUT using PI Query for BCF. Confirm that the EUT transmits the Message 4 with a position source indicating surveyed. Confirm that the ADS indicates the current position source.

10.2.7 Alarm Messages

10.2.7.1 Purpose

This test will verify that the Base Station will output alarm messages as required. Table 8 refers.

10.2.7.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions.

a) Disconnect the transmit antenna from the EUT.

b) Provide the EUT with an ACK with alarm value 1 using the PI.

c) Reconnect the transmit antenna to remove the alarm condition.

d) Prevent the EUT from radiating with full power by mismatching the antenna for a VSWR of 3:1

e) Provide the EUT with an ACK with alarm value 2 using the PI

f) Reconnect the transmit antenna to remove the alarm condition.

10.2.7.3 Required results

a) Confirm that the EUT continues to generate an ALR sentence with alarm value 1 to the PI once per minute.

b) Confirm that the EUT generates an ALR sentence with alarm value 1 with an acknowledged status once the ACK has been received.

c) Confirm that the EUT generates an ALR sentence with an ALR ID and Status V, V in the alarm field.

d) Confirm that the EUT continues to generate an ALR sentence with alarm value 2 to the PI once per minute.

e) Confirm that the EUT generates an ALR sentence with alarm value 2 with an acknowledged status once the ACK has been received.

f) Confirm that the EUT generates an ALR sentence with a ALR ID and Status V, V and every minute an ALR sentence with null value in the alarm field.

10.3 Intentional Slot reuse (link congestion)

10.3.1 Purpose

Verify that the EUT will operate properly in a > 90% load environment.

10.3.2 Method of measurement

Set-up standard test environment and operate the EUT as defined in the Pre-Setup conditions. Ensure that the signal level received from EUT exceeds the signal level received from the test transmitter at the test receiver location.

a) Set up additional test targets to simulate a VDL load of > 90%. Wait at least one minute.

b) Apply a TSA sentence and a VDM sentence with encapsulated message Message 8 to EUT.

c) Stop additional test targets and wait at least one minute.

NOTE The following tests are required for a Base Station operated as an independent unit.

d) Apply the following BCE to enable RATDMA

$xxBCE,AA003770008,1,,*hh<CR><LF>

e) Set up additional test targets to simulate a VDL load of > 90%. Wait at least one minute.

f) Transmit a 1 slot binary broadcast Message 8 using RATDMA.

10.3.3 Required results

a) Confirm that the EUT generates the required VDM sentences for all messages.

b) Confirm that the EUT transmits in the assigned slot and channel.

Confirm that the EUT generates the required TFR with status 0.

c) Record transmitted messages and check frame structure.

NOTE The following results are required for a Base Station operated as an independent unit.

d) Confirm that the BCE sentence was received correctly.

Confirm that the EUT generates the required VDM sentences for all messages.

e) Confirm that the EUT generates the required VDM sentences for all messages.

f) Confirm that the slot used by the slot reuse algorithm is a random selection within the candidate slots (4 most distant stations). Check that a station is not subject to slot reuse more than once a frame. Check that slots allocated by a local Base Station are not subject to slot reuse.

Annex A
(Normative)

AIS Base Station Sentences

A.1 Format definition of input / output sentences specifically defined for AIS Base Stations in accordance with the data structures of IEC 61162-1

A.1.1 ACM – Preparation and Initiation of an AIS Base Station Broadcast of an Addressed Channel Management Message (ITU-R M.1371 Message 22)

This sentence is used to provide an AIS Base Station with the information it uses to broadcast an "addressed VDL message 22." This contains settings that are broadcast to one or two specified AIS station(s). Upon receiving this sentence, the Base Station should prepare and make the appropriate broadcast (See ITU-R M.1371 Message 22).

$--ACM,xxxxxxxxx,xxxxxxxxx,xxxx,x,xxxx,x,x,x,x*hh<CR><LF>

- Broadcast Channel for Base Station[6]
- Power level control[5]
- TX/RX mode control[4]
- Channel B bandwidth[3]
- Channel B[2]
- Channel A bandwidth[3]
- Channel A[2]
- MMSI of the addressed AIS unit 2[1]
- MMSI of the first addressed AIS unit 1[1]

Notes:

1. Identifies the distant addressed AIS unit(s) intended to receive the ITU-R M.1371 message 22. The first MMSI field (field 1) identifies the first AIS unit. The second MMSI field (field 2) identifies the second AIS unit, and may be set to null if only one AIS unit is being addressed.
2. VHF channel number, see ITU-R M.1084, Annex 4.
3. 0 = bandwidth is specified by channel number, see ITU-R M.1084, Annex 4

   1 = bandwidth is 12.5 kHz
4. 0 = transmit on channels A and B, receive on channels A and B

   1 = transmit on channel A, receive on channels A and B

   2 = transmit on channel B, receive on channels A and B
5. 0 = high power

   1 = low power
6. The field identifies the channel that the Base Station should use to broadcast the ITU-R M.1371 message 22. (This field cannot be a "null" field)

   0 = No broadcast channel preference

   1 = broadcast on AIS channel A

   2 = broadcast on AIS channel B

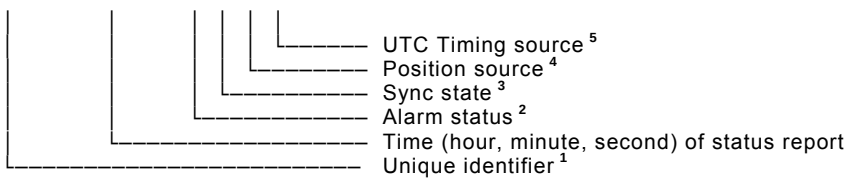
   3 = broadcast on both AIS channel A and AIS channel B

A.1.2 ADS – AIS Device Status

This sentence is used to output, autonomously and periodically, the current AIS station status condition.

For a Base Station this shall be output once per minute or when there is a change in the status. Null Data Fields are not allowed. The ADS sentence is invalid if it contains any number of null Data Fields.

$--ADS,c--c,HHMMSS.SS,x,x,x,x*hh<CR><LF>



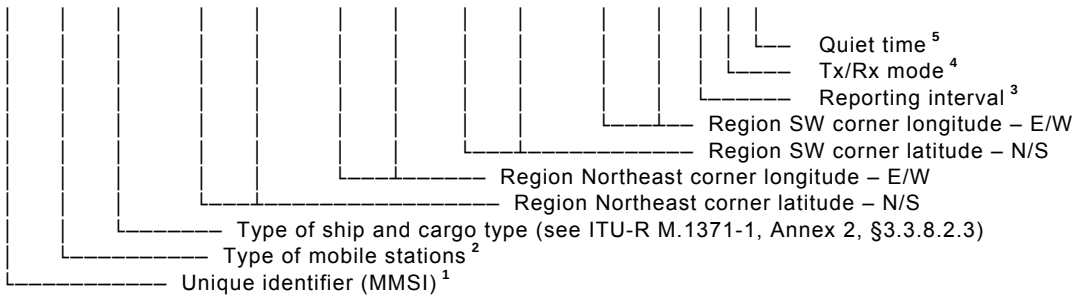
NOTES:

1. This is the “Unique Identifier” for the talker providing the signal information (e.g., MMSI of an AIS station that transmits, or station identification of another type of device or process). Also see the SID Sentence Formatter.
2. A = Active V = Not active
3. 0 = UTC Direct
   1 = UTC Indirect
   2 = Station synchronised to a Base Station
   3 = Station is semaphore
   4 = No VDL synchronization reference
4. I = Internal
   E = External
   S = Surveyed
   N = None
5. E = External
   I = Internal
   N = None

A.1.3 AGA – Preparation and Initiation of an AIS Base Station Broadcast of a Group Assignment Message (Message 23)

This sentence is used to provide an AIS Base Station with information it uses to broadcast a “Group Assignment Message 23”. Upon receiving this sentence, the Base Station should prepare and make appropriate broadcast.

$--AGA,c--c,x.x,xxx,llll.ll,a,yyyyy.yy,a,llll.ll,a,yyyyy.yy,a,xx,x,xx*hh<CR><LF>



Notes:

1. This is the “Unique Identifier” of the Base Station to which the information in this AGA sentence is intended (See SID Sentence Formatter). This Data Field must match the Base Station’s Unique Identifier. The Base Station should ignore this sentence when this Data Field does not match the Base Station’s “Unique Identifier”

2. The field identifies the group of mobile stations for the group assignment
   0 = all types of mobiles, except Class A (default)
   1 = reserved for future use
   2 = all types of Class B mobiles
   3 = SAR airborne mobiles
   4 = AtoN stations
   5 = Class B“CS” stations
   6 = Inland waterway stations
   7-9 = for regional use
   10-15 = for future use

3. The field identifies the reporting interval as defined in table 17 of IEC 62287
   0 = as defined in autonomous mode
   1 = 10 minutes
   2 = 6 minutes
   3 = 3 minutes
   4 = 1 minute
   5 = 30 seconds
   6 = 15 seconds
   7 = 10 seconds
   8 = 5 seconds
   9 = 2 seconds
   10 = next shorter interval
   11 = next longer interval
   12-15 = reserved for future use

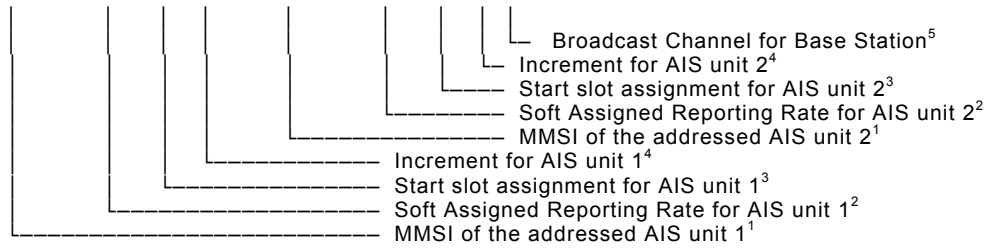
4. 0 = transmit on channels A and B, receive on channels A and B (default)
   1 = transmit on channel A, receive on channels A and B
   2 = transmit on channel B, receive on channels A and B
   3 = reserved for future use

5. 0 = no quiet time (default)
   1-15 = quiet time 1-15 minutes

A.1.4 ASN – Preparation and Initiation of an AIS Base Station Broadcast of Assignment VDL Message 16.

This sentence is used to provide an AIS Base Station with the information it uses to broadcast an "assignment VDL message 16". This contains settings that are broadcast to the specified AIS station(s). Upon receiving this information, the Base Station should prepare and make the appropriate broadcast (See ITU-R M.1371-1, §3.3.8.1, Message ID 16).

$--ASN,xxxxxxxxx,x.x,x.x,x,xxxxxxxxx,x.x,x.x,x,x*hh<CR><LF>



Notes:

1. Identifies the distant addressed AIS unit(s) for the VDL assignment. The first set of four fields apply to a single AIS unit, while the second set of four fields (fields 5 – 8) apply to a second AIS unit. When only one AIS unit's assignment schedule is being provided, the second set of four fields (fields 5 – 8) may be set to null.
2. This field corresponds to the ITU-R M.1371 Message 16 Offset field. The Base Station will only use this field if the "Increment for AIS" field (fields 4 and 8 of this sentence) for the same AIS unit is set to zero. The range of values for this field consists of multiples of 20, between and including 20 to 600. Values that are less then 600 but are not multiples of 20 will be interpreted as the next higher multiple of 20. Values above 600 will be interpreted as 600. This field shall be set to null when the "Increment for AIS" field (fields 4 and 8 of this sentence) for the same AIS unit is set to a non-zero value.
3. When the increment field is non-zero, this field is the start slot for assigned reports. The Base Station must provide the proper Message 16 off-set at time of broadcast to accomplish this assignment. The Base Station calculates the Message 16 "off-set" as the difference of this start slot and the slot of the broadcast. The range of values for this field consists 0 to 2249 in units of slots. This field shall be set to null when the "Increment for AIS" field (fields 4 and 8 of this sentence) for the same AIS unit is set to a zero value.
4. This field identifies the increment parameter in units of slots for the associated values of this field. The range of values is from 0 to 6. Note that a value of zero does not provide an increment, see note 2 above. This field shall not be set to null, unless the entire four field set for this AIS unit is not provided, because the Base Station may invoke two distinctly different assignment methods based on a zero or non-zero value. The values and their meanings are:

   0 = Reporting rate is based upon the "Soft Assigned Reporting Rate for same AIS unit" (fields 2 and 6) / 10 minutes

   1 = 1125 slots

   2 = 375 slots

   3 = 225 slots

   4 = 125 slots

   5 = 75 slots

   6 = 45 slots
5. The field identifies the channel that the Base Station should use to broadcast the ITU-R M.1371 message 16. A null value in this field indicates no change from previous received value when this sentence is sent to a Base Station and indicates unknown when this sentence is received from a Base Station. The values and their meanings for this are:

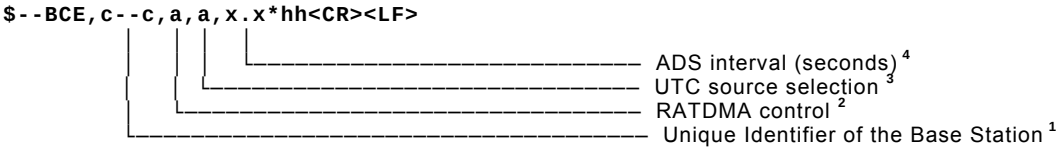
   0 = No broadcast channel preference

   1 = broadcast on AIS channel A

   2 = broadcast on AIS channel B

A.1.5 BCE – Extended General Base Station Configuration

This sentence and the BCF sentence are used to configure the Base Station parameters when it is initially installed, and later in order to make changes to the way it operates. This sentence is also used to monitor the UTC synchronization source being used by the Base Station. This sentence supports system administration of the AIS Base Station operation.



Notes

1. This Data Field is the “Unique Identifier” of the Base Station to which the information in this sentence is intended (See SID Sentence Formatter). This Data Field must match the Base Station’s Unique Identifier. The Base Station should ignore this sentence when this Data Field does not match the Base Station’s “Unique Identifier”
2. Controls the Base Station’s ability to use RATDMA access to the VDL:

   0 = off (Base Station cannot use RATDMA access to VDL)

   1 = on (Base Station may use RATDMA access to VDL)
3. Controls the UTC synchronization source used by the Base Station:

   E = external UTC source

   I = internal UTC source

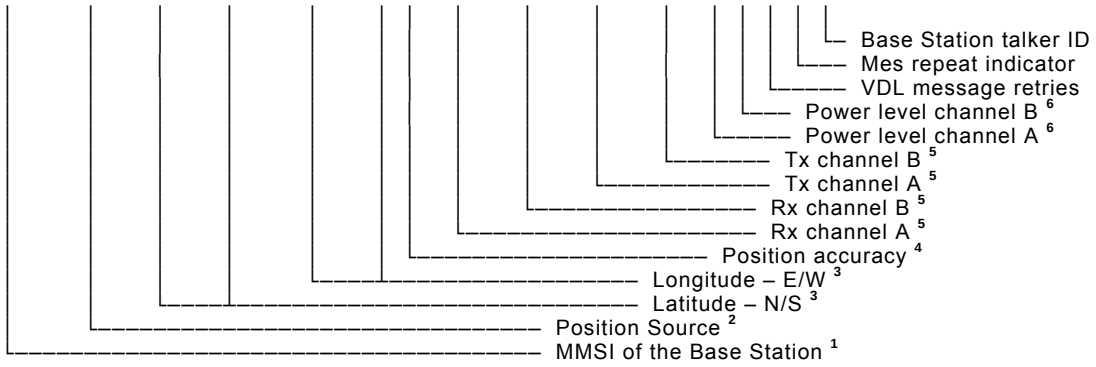
   X = external UTC source with fallback to internal UTC source

   Y = internal UTC source with fallback to external UTC source, if available
4. This Data Field sets the interval between the output of “AIS Device Status” sentences (See ADS sentence.). If this Data Field is negative, the ADS sentences should not be provided.

A.1.6 BCF – General Base Station Configuration

This sentence and the BCE sentence are used to configure the static Base Station parameters when it is initially installed, and later in order to make changes to the way it operates. Dynamic parameters (e.g. UTC and position of a moving Base Station) are input in a different way. This sentence supports system administration of the AIS Base Station operation.

$--BCF,xxxxxxxxx,x,llll.ll,a,yyyyy.yy,a,x,xxxx,xxxx,xxxx,xxxx,x,x,x,x,aa*hh<CR><LF>



NOTES

1. This Data Field is the MMSI of the Base Station. In early Base Stations, this Data Field set the MMSI of the Base Station. For Base Stations built to comply with IEC 62320-1, this Data Field should not be used. The attached "Comment Block" parameter-code "d:" should be used to test if this sentence is intended for this Base Station. The Base Station should ignore this sentence if the parameter-code "d:" value in the attached Comment Block does not match the internal "Unique Identifier" (Also, see the SID sentence.).

2. Identifies the source of the position:

   0 = surveyed position

   1 = internal EPFD in use

   2 = external EPFD in use

   3 = internal EPFD in use with automatic fall back to surveyed position

   4 = internal EPFD in use with automatic fall back to external EPFD upon failure of internal EPFD

   5 = external EPFD in use with automatic fall back to surveyed position

   6 = external EPFD in use with automatic fall back to internal position source upon failure of external position source

3. Surveyed position of the Base Station. The position is only applicable to fixed Base Stations. Within the Base Station, the "electronic position fixing device" Data Field must be set to a value of 7 indicating a surveyed position. Mobile or non-fixed Base Stations receive their position information by another means.

4. 0 = low > 10m.

   1 = high < 10m; differential mode of DGNSS.

5. VHF channel number, see ITU-R M.1084, Annex 4.

6. 0 = high power (Nominal 12.5 Watts)

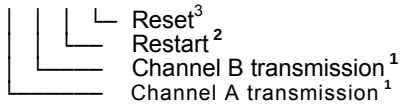
   1 = low power (Nominal 2 Watts)

   2 to 9 reserved for future use

A.1.7 CAB – Control AIS Base Station

This sentence is used to turn on or off the transmission of channel A and B on an AIS Base Station and also to command a restart of the Base Station. This sentence supports system administration of the AIS Base Station operation.

$--CAB,x,x,x,x*hh<CR><LF>



NOTE 1 The field commands the Base Station to turn on or off transmissions on the selected channel (fields 1 or 2). There are two valid values for the field:
0 = Off
1 = On

NOTE 2 This field commands the Base Station to restart operations to last known configuration. The value of “1” indicates a restart. If a restart is not being indicated, this field is null.

NOTE 3 This field commands the Base Station to reset all configuration information to undefined, with exception of receive only on AIS1 and AIS2. The value of “1” indicates a reset. If a reset is not being indicated, this field is null.

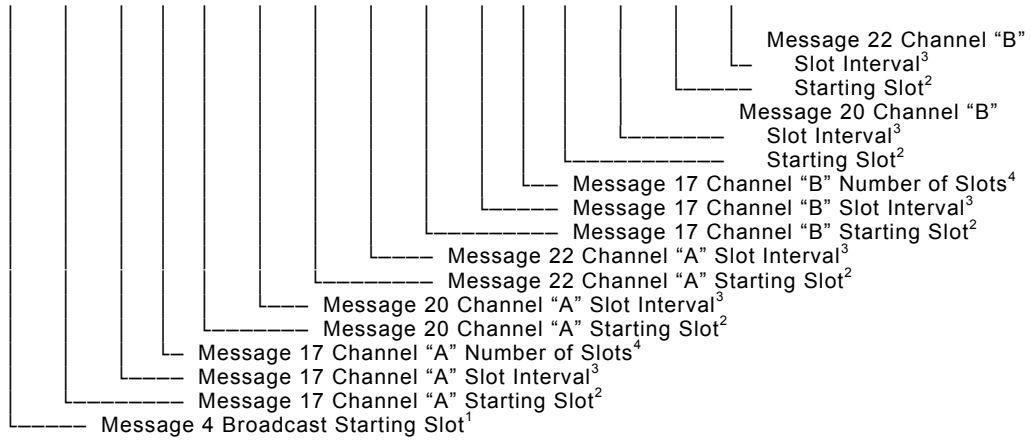
A.1.8 CBM –Configure Base Station Message Broadcast Reporting Rates

This sentence configures the broadcast schedule of ITU-R M.1371 messages 4, 17, 20 and 22 that are to be broadcast from an AIS Base Station. It establishes the broadcast schedule for each frame until changed. The AIS Base Station should apply the information provided by this sentence to autonomously and continuously transmit the VDL messages indicated until revised by a new CBM sentence. The AIS Base Station, upon receipt of a Query for this sentence, will generate this sentence providing the current broadcast schedule of ITU-R M.1371 messages 4, 17, 20 and 22 to the requestor.

New CBM assignments will override CBM or ECB assignments.

NOTE This sentence cannot control message 23 (See ECB sentence).

$--CBM,x.x,x.x,x.x,x,x.x,x.x,x.x,x.x,x.x,x.x,x,x.x,x.x,x.x,x.x *hh<CR><LF>



NOTES:

1. Starting slot ranging from –1 to 749 for ITU-R M.1371 Message 4 broadcasts. The broadcasts alternate between the channels A and B through the end of the frame. The increment may vary, see ITU-R M.1371, Annex 1, 4.2.1, Table 1B and footnote 1 for details. A value of –1 discontinues broadcasts of message 4 when the CBM sentence is sent to the AIS equipment, and indicates that no message has been broadcast if the CBM sentence is received from the AIS equipment. A null field indicates no change to the current start slot setting when sent to the AIS equipment, and indicates that the start slot has not been set, i.e. is unavailable, when the CBM sentence is received from the AIS equipment. (ref. version of ITU-R M.1371-1 available on ITU WEB site).
2. Starting slot ranging from -1 to 2249 for ITU-R M.1371 messages 17, 20 or 22, broadcasts on Channels “A” or “B”. A value of –1 discontinues broadcasts of the message when the CBM sentence is sent to the AIS equipment, and indicates that no message has been broadcast if the CBM sentence is received from the AIS equipment. A null field indicates no change to the current start slot setting when sent to the AIS equipment, and indicates that the start slot has not been set, i.e. is unavailable, when the CBM sentence is received from the AIS equipment.
3. Slot Interval ranging from 0 to 13500 in slots, between broadcasts of ITU-R M.1371 messages 17, 20 or 22 on Channels “A” or “B”. A value of 0 indicates only one broadcast is scheduled in the frame. A null field indicates no change to the current slot interval setting when sent to the AIS equipment, and indicates that the slot interval has not been set, i.e. is unavailable, when the CBM sentence is received from the AIS equipment. It should be noted that three slots for each GNSS system should be reserved for corrections. Caution should be taken for message 17 when defining the increment to ensure that both corrections and integrity warnings are considered.
4. For messages other than message 17, this field is null. For message 17 the number may range from 1 to 4 consecutive slots. A maximum of 3 slots is recommended for each DGNSS service.

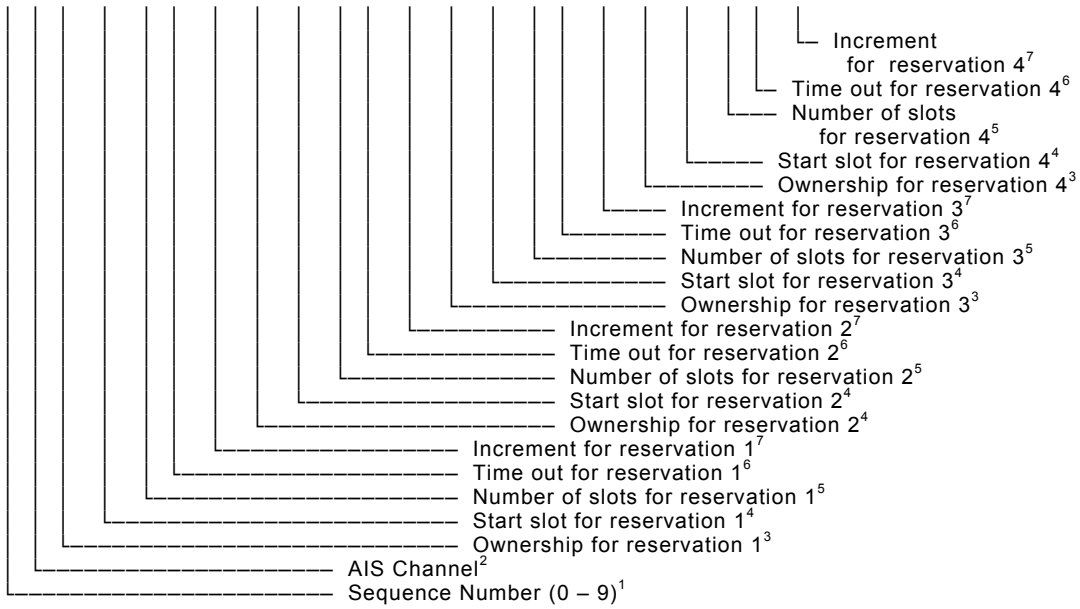
A null field indicates no change to the number of consecutive slots reserved when sent to the Base Station, and indicates that the number of consecutive slots has not been set, i.e. is unavailable, when the ECB sentence is received from the Base Station.

A.1.9 DLM – Data Link Management slot allocations for Base Station.

This sentence provides the Base Station with the slot allocations to be reserved for FATDMA Base Station broadcasts. This sentence provides the Base Station with the information necessary to broadcast an ITU-R M.1371 Message 20 Data link management message, which informs mobile AIS units of the reserved FATDMA slots. Upon receipt of this sentence the Base Station will reserve the provided FATDMA slot allocations within it's frame map, and will be ready to generate Message 20 when instructed to do so via the CBM or ECB sentence. This is the information that is broadcast on the VDL using message 20. Reference ITU-R M.1371-1, §3.3.8.2.16 (Also see CBM and ECB)

The shore station is responsible for filtering out slot reservation conflicts that may exist. The Base Station is not responsible for detecting these conflicts. These conflicts in the shore station network must be resolved separately from entering the data. The AIS Base Station, upon receipt of a Query for this sentence, will generate a response to the requestor consisting of multiple DLM sentences containing all the FATDMA reserved slots.

$--DLM,x,a,a,x.x,x,x,x.x,a,x.x,x,x,x.x,a,x.x,x,x,x.x,a,x.x,x,x,x.x*hh<CR><LF>



NOTES:

1. From template sequence number (Like the sequence number method used in the ACA/ACS sentence pair, this number is used to identify and address each DLM sentence record stored in the Base Station.) Note: The sequence number is used to associate the DLM field data with each of the AIS VDL "message 20's" that are broadcast by the Base Station"

2. The AIS Channel that the FATDMA reservation information is to be applied to. The character "A" indicates channel A and "B" indicate channel B. This cannot be a null field when sent to the Base Station. When received from a Base Station, this field may be null, indicating that no FATDMA slots have been reserved on either channel A or channel B.

3. This field identifies the ownership of the reservation. Possible values are as follows:

   L = Local ownership. The Base Station receiving this sentence owns and may utilize these FATDMA slots. The Base Station shall broadcast these FATDMA slot reservations.

   R = Remote ownership. A remote Base Station owns and may use these FATDMA slots. The local Base Station shall broadcast these FATDMA slot reservations.

   C = Clear the reservation. This instructs the Base Station receiving this sentence to clear this reservation from its frame map. If this field is set to "C", than the following four fields shall be set to null, and will be ignored if set otherwise.

   First reservation "ownership" - Indication of shore station ownership for each set of slot reservations; "L" for local, "R" for remote. A Base Station can broadcast slot reservations for another station. The Base Station is not allowed to use the slots reserved for stations other than itself. These are the remote (R) stations. It is allowed to broadcast on its own local (L) slots. Final slot selection is a process internal to the Base Station. The ownership should be subject to be overruled by sentence TBD 2 Rational: Utilise a slot pool used by several Base Stations.

4. Starting slot ranging from 0 to 2249. A null field indicates no change to the staring slot for this FATDMA reservation. When received from a Base Station, a null field indicates that the start slot has not been set, i.e. is unavailable, when the DLM sentence is received from the AIS equipment.
5. The number ranging from 1 to 5 of Consecutive Slots reserved for FATDMA broadcasts. A null field indicates no change to the number of consecutive slots reserved when sent to the AIS equipment, and indicates that the number of consecutive slots has not been set, i.e. is unavailable, when the DLM sentence is received from the AIS equipment.
6. The Time out in minutes ranging from 0 to 7 for the Slots reserved for FATDMA broadcasts. A null field indicates no change to the number of consecutive slots reserved when sent to the AIS equipment, and indicates that the number of consecutive slots has not been set, i.e. is unavailable, when the DLM sentence is received from the AIS equipment.
7. Slot increment ranging from 0 to 1125 in slots. A value of 0 indicates only one broadcast is scheduled in the frame. A null field indicates no change to the current slot increment setting when sent to the AIS equipment, and indicates that the slot increment has not been set, i.e. is unavailable, when the DLM sentence is received from the AIS equipment. When the increment is not “0” the following formula should apply:

   2250 mod Increment = 0

   Rationale: To ensure the periodical slot reservation from frame to frame (See ITU-R M.1371, A2,§3.3.4.3.2)

A.1.10 ECB –Configure Broadcast Rates for Base Station Messages with Epoch planning support.

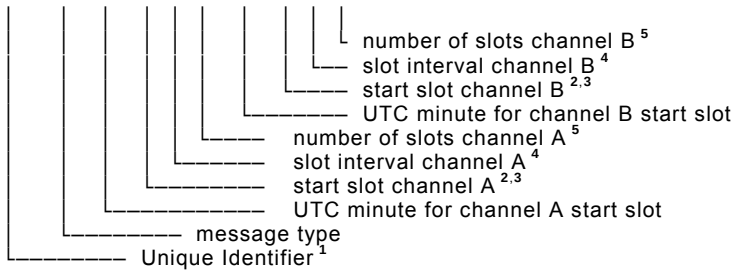
This sentence assigns the schedule of slots that will be used to broadcast the specified message – 4, 17, 20, 22, and 23. It provides the start slot and interval between the slots used for consecutive transmissions for the message. The interval span supports creation of broadcast schedules base upon a 6 minute FATDMA epoch. The AIS Base Station should apply the information provided by this sentence to autonomously and continuously transmit the VDL message indicated until revised by a new ECB sentence.

Note: The interval span in this sentence supports FATDMA planning where six minute epochs are used. When planning the FATDMA use of VDL slots, time can be organized into six minute periods identified using FATDMA "epoch numbers" (0 to 9). The start of a FATDMA epoch is correlated with the beginning of the hour. An FATDMA epoch starts with the first second of the first minute, and ends with the end of second 59 of the sixth minute of the epoch. The FATDMA epoch number of each FATDMA epoch in one hour is correlated to an absolute start minute within the hour (FATDMA epoch number × 6). For example, FATDMA epoch "0" is minute 0 through 5, and FATDMA epoch "9" is minute 54 through 59.

The AIS Base Station, upon receipt of an ECB Query for this information, will generate sentences for all message types (4, 17, 20, 22, and 23) providing the current broadcast schedule. Even unscheduled messages need to be reported.

New ECB assignments will overide existing CBM or ECB assignments.

$--ECB,c--c,x,x.x,x,x,x,x.x,x,x,x*hh<CR><LF>



NOTES:

1. This Data Field is the "Unique Identifier" of the Base Station to which the information in this sentence is intended (See SID Sentence Formatter). This Data Field must match the Base Station's Unique Identifier. The Base Station should ignore this sentence when this Data Field does not match the Base Station's "Unique Identifier"

2. For message 4, starting slot ranging from –1 to 749 should be used. The broadcasts should alternate between the channels A and B. The increment may vary; see ITU-R M.1371-1, Annex 1, 4.2.1, Table 1B and footnote 1 for details. A value of –1 discontinues broadcasts of message 4 when the ECB sentence is sent to the Base Station, and indicates that message 4 has been turned off if the ECB sentence is received from the Base Station. A null field indicates no change to the current start slot setting when sent to the Base Station, and indicates that the start slot has not been set when the ECB sentence is received from the Base Station.

3. For messages 17, 20, 22, or 23, starting slot ranging from -1 to 2249 should be used. A value of –1 discontinues broadcasts of the message when the ECB sentence is sent to the Base Station, and indicates that no message has been broadcast if the ECB sentence is received from the Base Station. A null field indicates no change to the current start slot setting when sent to the Base Station, and indicates that the start slot has not been set, i.e. is unavailable, when the ECB sentence is received from the Base Station.

4. Slot Interval ranging from 0 to 13500 in slots (epoch of 6 minutes) , between broadcasts of ITU-R M.1371 messages 17, 20, 22, or 23 on Channels "A" or "B". Interval selection for message 17 should consider the timing needs for both DGNSS corrections and integrity warnings. 5 seconds or less is recommended.

   A value of 0 indicates only one broadcast. A null field indicates no change to the current slot interval setting when sent to the Base Station, and indicates that the slot interval has not been set, i.e. is unavailable, when the ECB sentence is received from the Base Station.

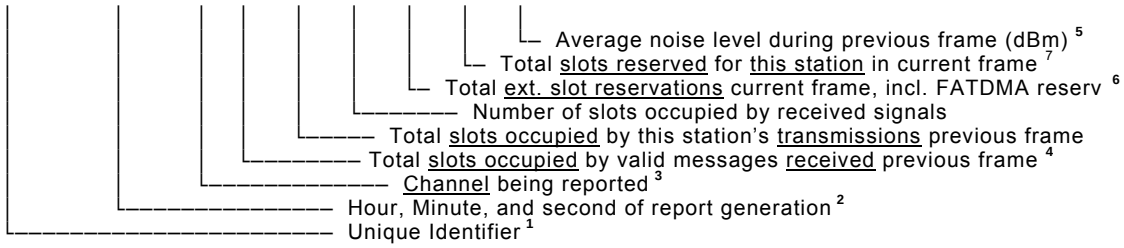
5. For messages other than message 17, this field is null. For message 17 the number may range from 1 to 4 consecutive slots. A maximum of 3 slots is recommended for each DGNSS service.

   A null field indicates no change to the number of consecutive slots reserved when sent to the Base Station, and indicates that the number of consecutive slots has not been set, i.e. is unavailable, when the ECB sentence is received from the Base Station.

A.1.11 FSR – Frame Summary of AIS Reception

The Data Fields in this sentence provide a summary of AIS channel conditions for the previous frame. Each sentence provides a summary for one channel. The sentence is output once per frame – after completion of the frame.

$--FSR,c--c,HHMMSS.SS,a,x.x,x.x,x.x,x.x,x.x,x.x,x.x*hh<CR><LF>



NOTES:

1. This Data Field is the "Unique Identifier" of the Station providing the frame summary. This Data Field must match the Station's Unique Identifier.
2. the time when this sentence is assembled. This sentence cannot be assembled before the end of a frame
3. A = Channel A

   B = Channel B

   [In case of channel management there can be a situation where Base Stations operate in a transition zone. Where there are more than two AIS channels, there may be a need for two or more Base Stations – operating on the international and local channels. Each Base Station must have a unique MMSI and will be addressed separately. The same may apply to two Base Stations installed at one location but responsibe for geographic sectors using directional antennas.]
4. Exclude slots occupied by this station' transmissions.
5. Always negative.

   0 = requested but not available

   If a Data Field is not enabled using the BOC sentence, the Data Field content will apply the IEC 61162-1 "null field" notation for no information.
6. Exclude slots "reserved" for use by this station. The calculation of the current frame's slot reservations should be done during the first slot. The total should not include additional reservations made for slots in the current frame by messages received during the current frame.
7. The calculation of the current frame's slot reservations should be done during the first slot. The total should not include additional reservations made for slots in the current frame during the current frame.

A.1.12 SID – Installation of a Station's Identification

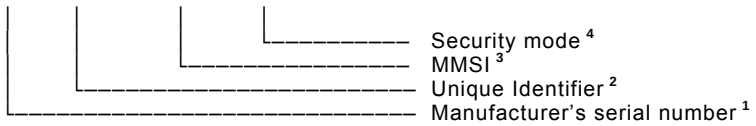
This sentence is used to configure (install or change) the value of a device's station identification (or for a transmitting device, the MMSI of the device). This must be a numeric value for a device that is required to broadcast a communications MMSI, but may be an "alphanumeric string" for non-transmitting devices. This sentence requires the use of the "manufacturer's serial number". The manufacturer's serial number is obtained from a device by using a "query" for a VER sentence (See field 4 of the VER sentence.).

Data Field 1 is used by the device receiving this sentence to confirm that it is the proper recipient of this sentence. Data Field 2 contains the MMSI or station identifier that the unit should install or change. If Data Field 1 does not match the device's internal manufacturer's serial number, the device should ignore this sentence.

Proper installation of a station's identification should be confirmed using a query for a VER sentence.

This sentence supports system administration of the AIS Base Station operation.

$--SID,c--c,c--c,xxxxxxxxx,a*hh<CR><LF>



NOTES:

1. The manufacturer's serial number should be obtained from the device using a query for a VER sentence.

   Note, this "internal" manufacturer's serial number may or may not match the physical serial number of the device.

2. The "Unique Identifier" is used for "system level identification of a device," and may be up to 11 alphanumeric characters.

   If appropriate, this Data Field may be the same as the "MMSI" Data Field. For example, for an AIS station that transmits this is usually the MMSI of the station. When multiple Base Stations are co-located and using the same MMSI, this Data Field facilitates separate communications with each device. AIS devices that do not require the use of an MMSI radio transmission identification may use an alphanumeric string.

   Also, see the VER sentence.

3. This is a nine-digit number. If needed to maintain nine digits, leading zeros are required. Co-located transmitting devices may have the same MMSI. AIS devices that do not transmit are not required to have an MMSI, and this field is ignored.

4. Used to enable or disable PI security functions (addressing is required for all configuration sentences that may use comment blocks, section A3 refers):

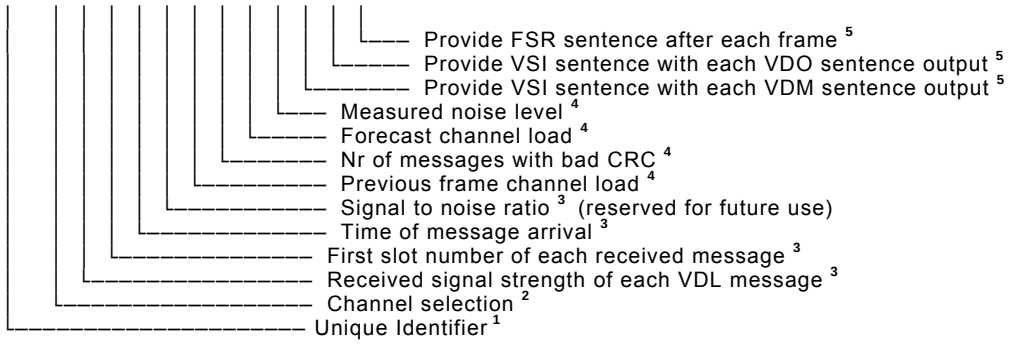
   D = disable the security functions

   E = enable the security functions

A.1.13 SPO – Select AIS Device's Processing and Output

This sentence is used to configure the content and output for measurements made on selected channels during operation of a Base Station or a Receiving Station. When a Data Field(s) is selected, the corresponding VSI and/or FSR sentence(s) will be output following the rules for those sentence formatters.

$--SPO,c--c,a,x,x,x,x,x,x,x,x,x,x,x*hh<CR><LF>



NOTES:

1. This Data Field is the "Unique Identifier" of the Base Station to which the information in this sentence is intended (See SID Sentence Formatter). This Data Field must match the Base Station's Unique Identifier. The Base Station should ignore this sentence when this Data Field does not match the Base Station's "Unique Identifier"
2. A = Channel A

   B = Channel B

   E = Every channel

   N = No VSI or FSR sentences about any channel
3. 0 = no output

   1 = continuous output

   2 = output next frame only
4. 0 = no output

   1 = output once per frame

   2 = output next frame only
5. 0 = off, disabled

   1 = on, enabled

A.1.14 TFR – Transmit Feed-back Report

The TFR sentence is an automatically generated by the Base Station to report to the Physical Shore Station the scheduled slot use and status of a requested transmission.

Several Data Fields are copied from the TSA and VDM sentences responsible for this TFR. They are provided to assist in linking this Base Station response to the responsible TSA/VDM sentence(s).

After receiving associated TSA and VDM sentences, the Base Station responds with a TFR sentence that provides status information about the requested transmission.

After receiving a VDM sentence without an associated TSA sentence (as when requested transmissions are not assigned to a specific starting slot), the Base Station responds with a TFR sentence to report the scheduled channel, assigned time, assigned slot number, and status of the requested transmission.]

$--TFR,x,x,a,c--c,HHMMSS.SS,x.x,HHMMSS.SS,x.x,x,x,x.x*hh<CR><LF>

- Status [11]
- Transmission Priority [10]
- Number of consecutive time slots for message [9]
- Start slot number assigned to requested transmission [8]
- UTC hour and minute assigned to requested transmission [7]
- Start slot number of requested transmission [6]
- UTC hour and minute of requested transmission [5]
- Unique Identifier [of AIS device] [4]
- Channel requested for message being reported [3]
- Sequential message identifier used with message being reported [2]
- Total number of sentences used to transfer the message being reported [1]

NOTES:

1. Exact copy of the first Data Field of the VDM sentence to which this TFR is responding – “total number of sentences needed to transfer the message.”
2. Exact copy of the third Data Field of the VDM sentence to which this TFR is responding – “Sequential message identifier.”
3. Actual channel scheduled for the requested transmission. It should be an exact copy of the fourth Data Field of the VDM sentence to which this TFR is responding – “AIS Channel.”
4. This is the “Unique Identifier” of the device providing this TFR (See SID Sentence Formatter).
5. UTC hour and minute scheduled for the requested transmission. This should be an exact copy of the sixth Data Field of the TSA sentence to which this TFR is responding – “ UTC hour and minute of requested transmission.” This is null when there is no TSA sentence with the VDM sentence.
6. This should be an exact copy of the seventh Data Field of the TSA sentence to which this TFR is responding – “Start slot number of requested transmission.” This is null when there is no TSA sentence with the VDM sentence.
7. UTC hour and minute assigned for the requested transmission. This is determined by the Base Station for a received VDM sentence when no associated TSA sentence is received. This is null when associated TSA and VDM sentences are received.
8. Start slot number assigned for requested transmission. This is determined by the Base Station for a received VDM sentence when no associated TSA sentence is received. This is null when associated TSA and VDM sentences are received.
9. Actual number of slots that are scheduled for the transmission of the requested message. This takes into consideration bit stuffing.
10. Priority is either that requested in the TSA sentence or that assigned by the Base Station.

    1 = high priority,

    2 = low priority (default value).
11. 0 = successfully scheduled for transmission

    1 = successfully scheduled for transmission by overriding an internal message with a lower priority

    2 = not scheduled because requested transmission was outside the scheduling window

    3 = not scheduled because requested transmission exceeded available memory

    4 = not scheduled because requested transmission arrived too late to be scheduled

5 = not scheduled because requested transmission conflicted with slot(s) requested by an internal Base Station process that has the same or higher priority

6 = not scheduled because requested message type is not allowed by the Base Station configuration

7 = not scheduled because requested message conflict to prohibit slots.

8 = configuration error (see linked configuration sentence). Linked to this error should be the appropriate sentence containing the current configuration values for all fields

9 = not scheduled because requested transmission is for a disabled channel

10 = not scheduled because of invalid TSA content (e.g. invalid slot number)

Remark: the VDO+VSI will provide verification of the transmission itself

A.1.15 TSA - Transmit Slot Assignment

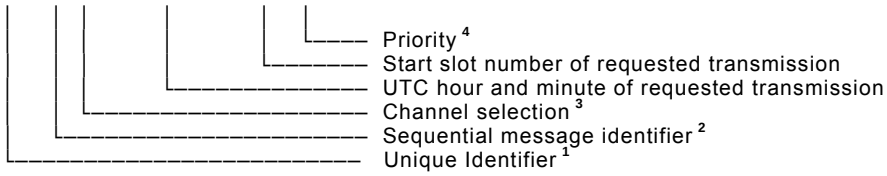
This sentence can be used by the Physical Shore Station to command that a Base Station transmit the VDL message encapsulated in the associated VDM sentence(s) beginning in the specified time slot. The TSA/VDM sentence combination is used for individual message transmissions only.

The TSA sentence should appear first, and the VDM sentence(s) second. A long VDL message may require the use of several VDM sentences.

Note: When a received VDL message fits into one VDM sentence, the third VDM Data Field, "Sequential message identifier," is a null field. However, when a VDM sentence is used to command a Base Station transmit a VDL message, the "Sequential message identifier" always contains a value – even when the message fits into one VDM sentence. The "Sequential message identifier" in the TSA sentence is identical to the "Sequential message identifier in the associated VDM sentence(s).

The "Comment Block" parameter-code "xGy:" can also be used to "group" TSA and VDM sentences.

$--TSA,c--c,x,a,HHMMSS.SS,x.x,x*hh<CR><LF>



NOTES:

1. This is the "Unique Identifier" of the Base Station to which the information in this TSA sentence and the following VDM sentence(s) are intended (See SID Sentence Formatter). This sentence and the following VDM sentence should be ignored when this Data Field does not match the Base Station's "Unique Identifier."
2. The Sequential message identifier provides a message identification number from 0 to 9 that is sequentially assigned and is incremented for each new message. The count resets to 0 after 9 is used. Each sentence of a message contains the same sequential message identification number – the TSA sentence and each of the VDM sentences that are needed. Note that linking a TSA sentence with a VDM sentence(s) results in the need for the VDM sentence(s) to have the same Sequential message identifier as in the TSA sentence – even when only one VDM sentence is used.
3. This should be the same channel as indicated in the following VDM sentence.

   A = Channel A

   B = Channel B
4. 1 = high priority, can overrule internal Base Station schedule. May not interfere with multi-slot transmissions already in progress.

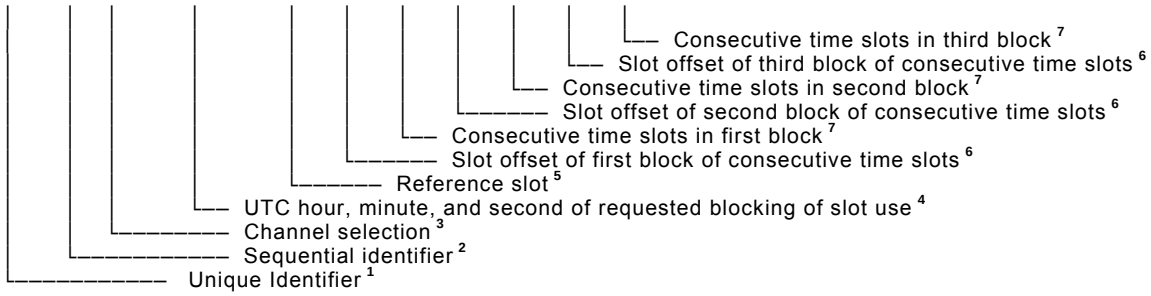
   2 = low priority, will transmit if slot is available

   Default is priority 2

A.1.16 TSP – Transmit Slot Prohibit

This sentence is used to prohibit an AIS station from transmitting in the specified slots. The AIS station receiving this sentence should not use the next occurrence of the indicated slots. This sentence is designed to be used to protect interrogation responses from interference from Base Station transmissions.

$--TSP,c--c,x.x,a,HHMMSS.SS,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x*hh<CR><LF>



NOTES:

1. This is the “Unique Identifier” of the Base Station to which the information in this TSP sentence is intended (See SID Sentence Formatter). This sentence should be ignored when this Data Field does not match the Base Station’s “Unique Identifier”
2. The Sequential identifier provides an identification number from 0 to 99 that is sequentially assigned and is incremented for each new TSP sentence. The count resets to 0 after 99 is used. This sequential identifier is used to identify the Base Stations slot blocking status report.
3. A = Channel A

   B = Channel B
4. This is for record keeping. It contains the hour, minute, and second of this request.
5. This is the slot from which the following slot offsets are referenced. This is frequently the slot assigned to a Message 15 interrogation.
6. Slot offset of the first slot in the block of slots to be blocked from use by the Base Station.

   0 indicates no prohibited slots
7. Total number of consecutive slots to be blocked from use by the Base Station. The first slot of the block is also part of the count. Therefore, the minimum value is 1.

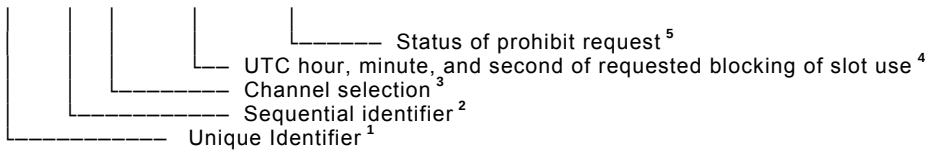
   0 = no prohibited slots

   1-5 = number of prohibited slots

A.1.17 TSR – Transmit Slot Prohibit status Report

This sentence is automatically generated to report the results of a TSP sentence.

$--TSR,c--c,x.x,a,HHMMSS.SS,x.x*hh<CR><LF>



NOTES:

1. This is the “Unique Identifier” of the Base Station providing this report (See SID Sentence Formatter).
2. Exact copy of the second Data Field (Sequential identifier) provided in the TSP sentence to which this TSR is responding. It is an identification number from 0 to 99 that is sequentially assigned and is incremented for each new TSP sentence. The count resets to 0 after 99 is used. This sequential identifier is used to identify the Base Station’s TSR slot phohibit status report.
3. Exact copy of the third Data Field (Channel selection) provided in the TSP sentence to which this TSR is responding.

   A = Channel A

   B = Channel B
4. Exact copy of the fourth Data Field (Hour, minute, and second) provided in the TSP sentence to which this TSR is responding.
5. 0 = successfully blocked prohibited slots

   1 = not successful because of internal reservation

   2 = not successful because action is not allowed by the Base Station configuration

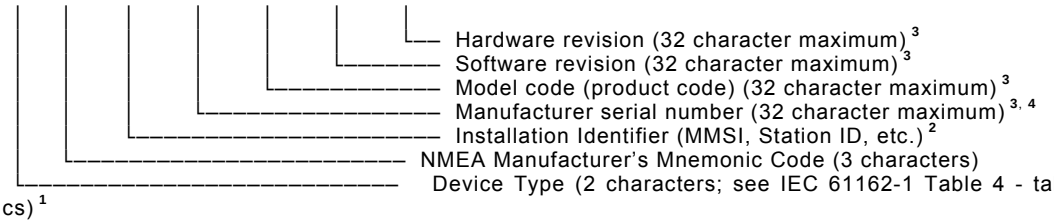
   3 = not successful because action is for a disabled channel

   4 = not successful because of invalid TSA content (e.g. invalid slot number)

A.1.18 VER – Version

This sentence is used, to provide information about a device. This information is obtained by the use of a "Query Sentence." All Data Fields, except the "Installation Identifier", should be manufactured into the device. The "Installation Identifier" can be installed using the SID sentence.

$--VER,aa,aaa,c--c,c--c,c--c,c--c,c--c*hh<CR><LF>



NOTES:

1. This is set into the equipment based upon the primary purpose of the device. This remains constant even if the "operational" sentence's talker identifier is changed. See the BCF Sentence Formatter, Data Field "Base Station talker ID."

   AB = AIS Base Station (See IEC 62320-1)

   AL = Limited Base Station (See IEC 62320-3)

   AS = Simplex Repeater Station (See IEC 62320-4)

   AD = Duplex Repeater Station

   AR = Receiving Station

   AI = Mobile Class A [or B] (See IEC 61993-2 and IEC 62287)

   AN = Aids to Navigation (See IEC 62320-2)

   Examples: For a GNSS receiver this field would be "GN", but while the receiver is producing only GPS position information, the sentence talker ID would be "GP".

   For a Class A AIS unit, this field would be AI, but while being used as only a receiver, the sentence talker ID would be "AR".

2. This identifier is used for "system level identification of a device," and may be up to 11 alphanumeric characters.

   For example, for an AIS station that transmits this is usually the MMSI of the station. An MMSI is restricted to a nine digit number. A proper MMSI is a fixed length nine digit numeric string with leading zeros (if needed). AIS devices that do not require the use of an MMSI radio transmission identification may use an alphanumeric string.

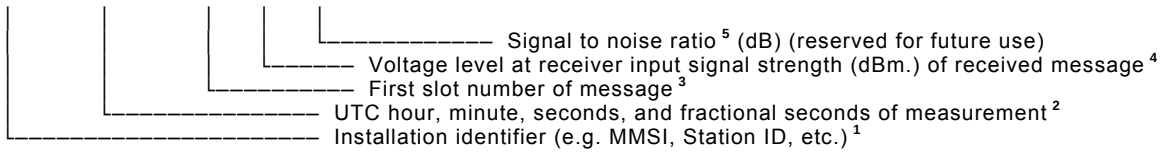
3. The Data Field length may be 32 characters maximum. The length of 32 characters was chosen in order to be consistent with similar data field lengths in the IEC 61162-3 standard. When large character lengths are used and the 80 character sentence limit would be exceeded for a single sentence, a series of successive VER sentences should be used to avoid the problem. Null fields can be used for Data Fields contained in other sentences of the series. Each of these VER sentences should contain the "Installation Identifier."

4. The manufacturer's unique serial number for the unit. Note, this "internal" manufacturer's serial number may or may not match the physical serial number of the device.

A.1.19 VSI – VDL Signal Information

This sentence provides measurement information associated with a received AIS message. This sentence is also used to identify the first slot of an AIS message transmission (linked to a VDO sentence). It is output in combination with either a VDM or VDO sentence.

$--VSI,c--c,HHMMSS.SS,x.x,x.x,x.x*hh<CR><LF>



NOTES:

1. This is the “Installation Identifier” for the talker providing the signal information (MMSI of an AIS station that transmits, or station identification of another type of device or process). In the case of a Base Station, the nine characters are restricted to numbers. Also see the SID Sentence Formatter.

2. This is the hour, minute, and second of a measurement. The fractional portion of a Time of Arrival (TOA) measurement can be given with a precision of 1 nanosecond. Where time is provided but there is either no TOA capability or no measurement is available, the fractional portion of the seconds are not provided.

   Example with a TOA measurement:

   \1G2:1234,s:r3669961,c:1120959341*2D\!ARVDM,1,1,,B,100000?0?wJm4:`GMUrf40g604:4,0*25

   \2G2:1234*79\$ARVSI,r3669961,013536.96326433,1386,-98,*35

   Example without a TOA measurement:

   \1G2:1234,s:r3669961,c:1120959341*2D\!ARVDM,1,1,,B,100000?0?wJm4:`GMUrf40g604:4,0*25

   \2G2:1234*79\$ARVSI,r3669961,013537,1386,-98,*16

3. 9999 = requested but not available

   This Data Field shall be null (comma comma) if the BOC sentence’s Data Field, “First slot number of each received message,” is set to “No output.”

4. 0 = requested but not available

   This Data Field shall be null (comma comma) if the BOC sentence’s Data Field, “Received signal strength of each VDL message,” is set to “No output.”

5. 0 = enabled [or requested] but not available

   This Data Field shall be null (comma comma) if the BOC sentence’s “Signal to noise ratio,” is set to “No output.”

A.2 Comment Block

The comment block permits the addition of non-IEC 61162-1 information into a character stream containing IEC 61162-1 defined sentences. The comment block can be used to adapt sentences to other systems (such as an AIS network) without an impact on the IEC 61162-1 standard.

By definition, a comment block must begin with a "\", and be closed with a "\". The "\" character is designated as the "comment block delimiter." The comment block always appears ahead of a standard sentence. The first comment block "\" appears after the <CR><LF> symbols and the comment block closing "\" appears before a symbol beginning a sentence, either a "$" or "!", or the <CR><LF> symbols. A comment block may be used without a following IEC 61162-1 sentence. It can also be part of a "group" (See "xGy" and example below.) without a following sentence. This can be useful when line length is a concern.

The contents of the comment block (valid characters between the two "\" characters) may contain any valid character (See IEC 61162-1, Table 2) and some of the reserved characters (See IEC 61162-1, Table 1). The comment block should not contain either the comment block delimiter, or the start of sentence delimiters, "$" or "!", or characters reserved for future use, "~" or <del>. The comment block contents is considered invalid if a start of sentence delimiter, "$" or "!", appears before the comment block is closed with a "\". The "$" or "!" is always recognized as the beginning of an IEC 61162-1 sentence.

The remaining reserved characters (<CR>, <LF>, ",", "*", and "^") in IEC 61162-1 Table 1 should be used as defined there.

A.3 Comment block parameters for AIS

This section describes the format, content, and rules to be used for inserting parameters into the comment blocks that are added to "AIS-sentences." Following that, examples are given where the format, content, and rules are applied to sentences used with AIS Base Stations or AIS receivers.

A.3.1 Comment Block parameter format

The general approach is to link each parameter value with a "parameter-code" that identifies the value. The proposal is for all parameters in a comment block to use the following general form:

\Parameter-code:value,parameter-code:value,[etc.]*hh

where the "parameter-codes" are defined in a parameter-code dictionary.

A.3.2 Comment Block "Hexadecimal Checksum" (*hh)

In order to improve the integrity of the parameters in a comment block, the "XOR" hexadecimal checksum (*hh), that is calculated for every IEC 61162-1 sentence, should also be used for the content of each comment block (See examples below.).

A.3.3 Parameter-code Dictionary

The following are parameter-codes and their definitions:

c: *(lower case "C")* Time in seconds calculated from midnight January 1, 1970. This is provided by the [find reference] Function of the "C" programming language. This is a general time tag that can be attached to a line. The specific significance of this value depends on why the "source" attaches this value to the line.

d: destination. Identification of intended listener device or process for the attached sentence. For a Base Station this is the SID sentence Data Field “Unique Identifier.”

esn: *(lower case “ESN”)* electronic serial number. Often used as password for a device’s security features (i.e. changing internal device settings or parameters).

i: *(lower case “I”)* information. This is free form text using valid characters (See IEC 61162-1, Table 2).

s: *(lower case “S”)* source. Identification of the talker device or process for the attached sentence. For a Base Station this is the SID sentence Data Field “Unique Identifier.”

xGy: Coding used to link lines into a group. This method applies the general rules for linking sentences as described in section [5.3.7 of the IEC 61162-101 PAS]. Each combination of a comment block and IEC 61162-1 sentence creates a “line”. A line containing only a comment block can be part of a group. The value of “x” (integer) indicates the line number within the group, and the “y” (integer) indicates the total number of lines in the group. The value with the parameter-code should be a unique string that is the same for each line in the group. This value is used to uniquely identify the lines of a group.

A.3.4 Line Linking [Sentence Linking]

The combined use of the comment block and parameter-code dictionary can be used to efficiently link IEC 61162-1 sentences into a group. Once linked, these groups can be transported by a variety of communication mediums (serial port, USB, UDP, TCP/IP network connection, etc.). In general, these are data connections with multi-talker / multi-listener relationships; or a single-talker / multi-listener relationship where there can be timing issues among the talker’s internal processes (See the examples below).

Examples:

\1G2:1234,s:r3669961,c:1120959341*2D\!ARVDM,1,1,,B,100000?0?wJm4:`GMUrf40g604:4,0*25

\2G2:1234*79\$ARVSI,r3669961,013536.96326433,1386,-98,*35

\1G2:2346,s:r3669962,c:1120959342*2A\!ARVDM,1,1,,B,15N1u<PP1cJnFj:GV4>:MOw:0<02,0*0C

\2G2:2346*7E\$ARVSI,r3669962,013538.05654921,1427,-101,*01

\1G2:1235,s:r3669961,c:1120959342*2F\!ARVDM,1,1,,B,15N1u<PP1cJnFj:GV4>:MOw:0<02,0*0C

\2G2:1235*78\$ARVSI,r3669961,013538.05656223,1427,-88,*39

\1G2:1236,s:r3669961,c:1120959344*2A\!ARVDM,1,1,,B,103OwmgP01Jn7WHGa4M6v?w<0D02,0*7E

\2G2:1236*7B\$ARVSI,r3669961,013539.44331849,1479,-51,*30

\1G2:2347,s:r3669962,c:1120959344*2D\!ARVDM,1,1,,B,103OwmgP01Jn7WHGa4M6v?w<0D02,0*7E

\2G2:2347*7F\$ARVSI,r3669962,013539.44333151,1479,-51,*31

The previous example may also be presented as follows:

\1G3:1234,s:r3669961,c:1120959341*2C\

\2G3:1234*78\!ARVDM,1,1,,B,100000?0?wJm4:`GMUrf40g604:4,0*25

\3G3:1234*79\$ARVSI,r3669961,013536.96326433,1386,-98,*35

\1G3:2346,s:r3669962,c:1120959342*2B\

\2G3:2346*7F\!ARVDM,1,1,,B,15N1u<PP1cJnFj:GV4>:MOw:0<02,0*0C

\3G3:2346*7E\$ARVSI,r3669962,013538.05654921,1427,-101,*01

\1G3:1235,s:r3669961,c:1120959342*2E\

\2G3:1235*79\!ARVDM,1,1,,B,15N1u<PP1cJnFj:GV4>:MOw:0<02,0*0C

\3G3:1235*78\$ARVSI,r3669961,013538.05656223,1427,-88,*39

\1G3:1236,s:r3669961,c:1120959344*2B\

\2G3:1236*7A\!ARVDM,1,1,,B,103OwmgP01Jn7WHGa4M6v?w<0D02,0*7E

\3G3:1236*7B\$ARVSI,r3669961,013539.44331849,1479,-51,*30

\1G3:2347,s:r3669962,c:1120959344*2C\

\2G3:2347*7E\!ARVDM,1,1,,B,103OwmgP01Jn7WHGa4M6v?w<0D02,0*7E

\3G3:2347*7F\$ARVSI,r3669962,013539.44333151,1479,-51,*31